3 Watershed Resource Inventory & Characterization

The chapter is a compilation and analysis of data that describes the condition of the Buffalo Creek Watershed, considering such factors as climate, soils, demographics, land use, natural resources, water resource assessments, etc. This characterization of existing conditions is important so that the challenges and opportunities in the watershed can be more fully understood, and it is the basis for developing recommendations for the watershed action plan.

3.1 Watershed Boundaries

As discussed in the Introduction Section of this report, a watershed is the area of land drained by a river/stream system or body of water. The Buffalo Creek Watershed comprises approximately 17,393 acres (27 square miles).

3.1.1 Topography

Topography defines the boundaries of the Buffalo Creek Watershed and is an essential component in the watershed planning process. Topographic data is used in the planning process to develop ***Hydrologic & Hydraulic*** (H&H) ***models***, floodplain maps, water quality models, flood mitigation recommendations, ***Subwatershed Management Units*** (SMUs), ***Digital Elevation Models*** (DEMs) and regionally significant depressional storage areas.

The topography of the Buffalo Creek Watershed was formed by glaciers that once covered the region. The watershed drains from the northwest to southeast. The upper watershed, shaped by the ***Tinley moraine***, is covered with hills of varying slopes and made of soils with moderately slow permeability. While the upper watershed does have some ***topographical relief***, the drainage is poorly defined. The northwest portion of the watershed contains the highest elevation at 895 feet above sea level. The southeast portion of the watershed contains the lowest elevation at 630 feet above sea level. Many areas drain into shallow wetlands or marshes, which have the same soil composition as the uplands with dark poorly drained organic soils mixed in. The lower watershed has limited topographical relief. This condition is especially true east of Elmhurst Road to the Des Plaines River, where the overland slope is approximately 0.001 feet/feet. As a result of the relatively flat slope, this part of the watershed also has poorly defined drainage patterns.

3.1.2 Watershed Delineation

The DEM shown in Figure 3-1 is a compilation of three data sets: the 2007 Lake County ***1-foot contours***, 2008 Cook County ***LiDAR***, and 2010 Cook County 1-foot contours. The Buffalo Creek Watershed was originally delineated by the U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS) as ***Hydrologic Unit Code*** (HUC) #071200040502. The watershed boundary was refined by the U.S. Army Corps of Engineers (USACE) as part of their Des Plaines River Phase II plan-

Digital Elevation Models (DEMs): *A digital model or 3D representation of a terrain's surface (commonly for a planet, moon, or asteroid) created from terrain elevation data.*

Subwatershed Management Units (SMUs): *An SMU is a small unit of a watershed or subwatershed that is used in watershed planning efforts. An example of an SMU would be the drainage area for an individual lake located in the watershed.*

Tinley Moraine: *An accumulation of unconsolidated glacial debris that parallels Lake Michigan and passes through Flossmoor, Western Springs, and Arlington Heights.*

Topographical Relief: *Refers to the variations in the height and slope of Earth's surface.*

1-foot Contours: *The change in elevation over 1 foot.*

LiDAR: *A Remote sensing method that uses light in the form of a pulsed laser to measure ranges to the earth. LiDAR can be used to produce shoreline maps and digital elevation models.*

Hydrologic Unit Code (HUC): *The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic area (cataloging units). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.*

ning efforts. Discrepancies between the HUC and USACE watershed delineations were identified as part of this planning effort. After coordination with SMC, Illinois EPA, and the USACE, it was determined that the use of the modified USACE watershed boundary and SMU delineation was appropriate and would be used for this plan. Revisions to the watershed delineation that were made as part of this planning effort included the following:

1. Addition of areas within Lake Zurich that are tributary to Buffalo Creek via storm sewer.
2. Removal of a portion of the Deer Grove Forest Preserve that is actually tributary to Salt Creek.
3. Removal of an area at the most downstream end of the watershed in Wheeling that actually drains to the mainstem of Des Plaines and not to the Buffalo Creek Watershed.

Supporting documentation on this revision process is provided in Appendix B. The current watershed boundary includes 17,393 acres and covers portions of Wheeling, Lake Zurich, and Arlington Heights ***USGS Quadrangles***.

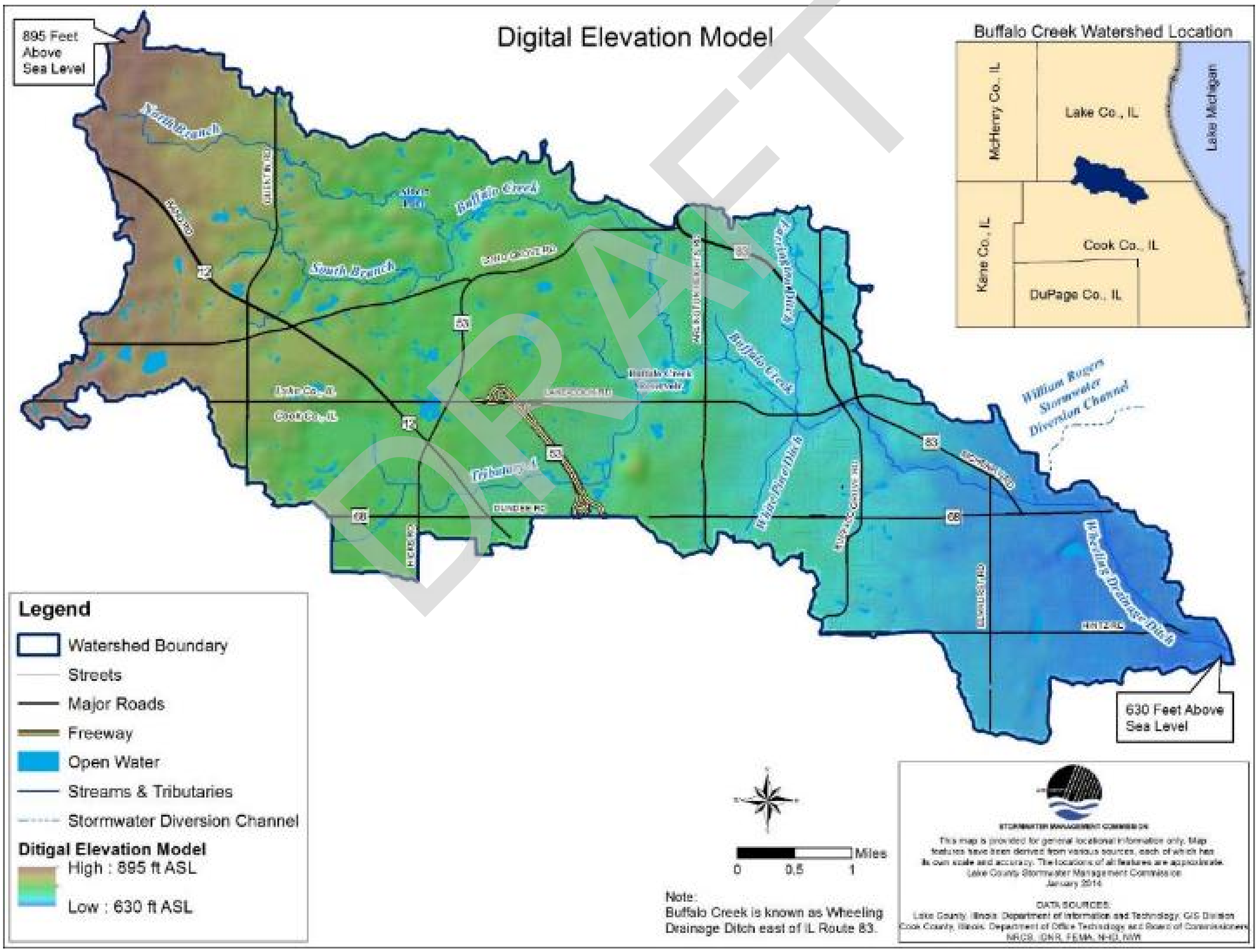


Figure 3-1: Digital Elevation Model of the Buffalo Creek Watershed.

3.1.3 Subwatershed Management Units

As part of the USACE watershed delineation discussed in Section 3.1.2, the watershed was further divided into 32 SMUs using USGS 7.5-minute series topographic maps, augmented with the 2-foot topography collected by the IDNR-OWR and 2000 LIDAR data. The Buffalo Creek Watershed area is 17,393 acres, consisting of 32 SMUs ranging in size from 78 acres to 1,943 acres. The average SMU size is 544 acres. **Figure 3-2** shows the location of SMUs in the Buffalo Creek Watershed. **Table 3-1** includes a breakdown of the SMUs in the Buffalo Creek Watershed and their respective acreages.

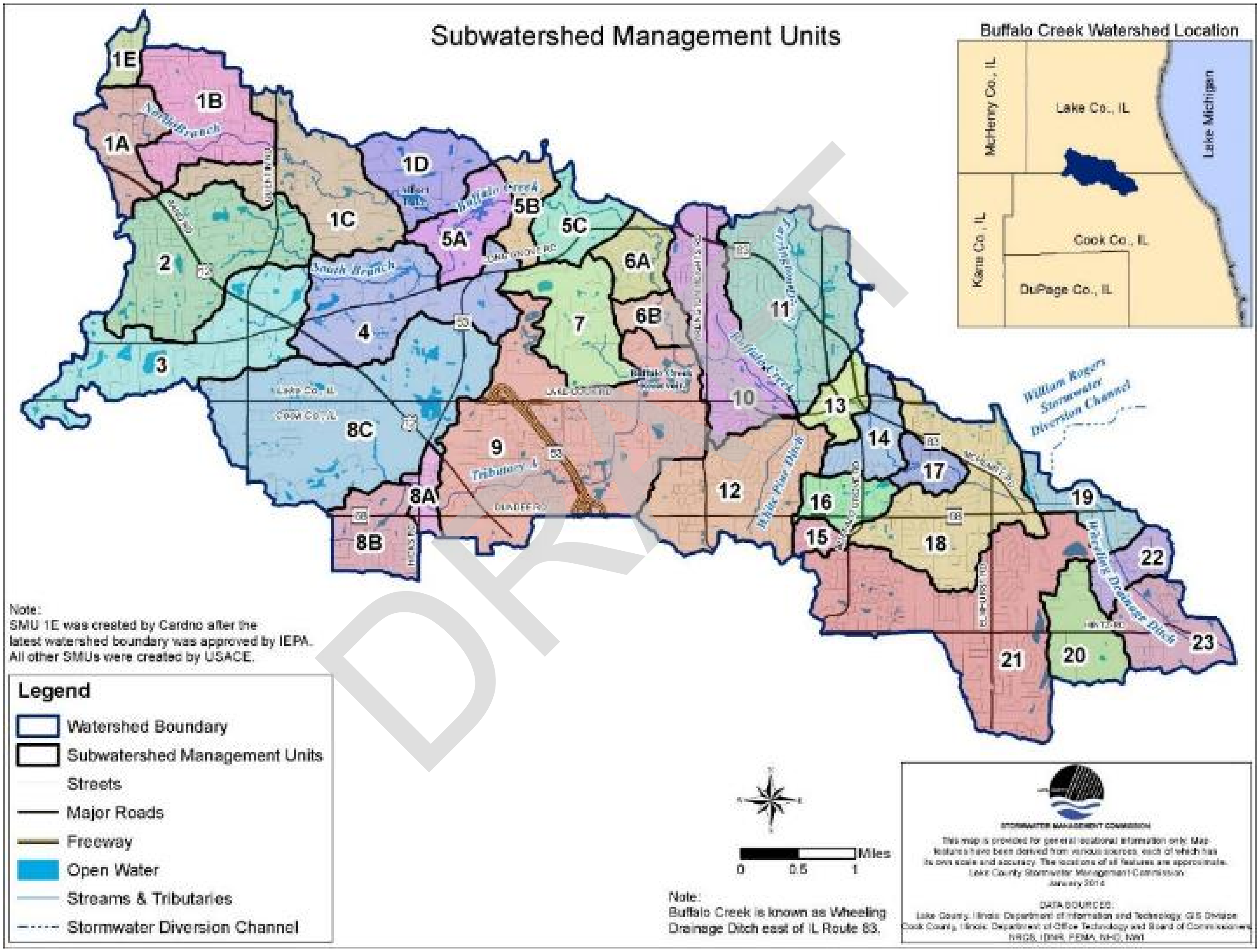


Figure 3-2: Subwatershed Management Units for the Buffalo Creek Watershed.

Table 3-1: Subwatershed Management Units for Buffalo Creek Watershed.

SMU	Area (Acres)	SMU	Area (Acres)	SMU	Area (Acres)
1A	332.4	6A	227.5	14	254.0
1B	611.0	6B	145.5	15	77.7
1C	747.7	7	505.0	16	209.9
1D	401.8	8A	107.3	17	139.4
1E	101.3	8B	335.7	18	884.7

2	967.8	8C	1630.2	19	232.8
3	903.9	9	1942.9	20	342.3
4	865.1	10	672.9	21	1452.7
5A	309.5	11	962.4	22	189.2
5B	193.3	12	827.5	23	380.7
5C	269.0	13	169.4		
				Total	17,393.0

3.2 Climate and Precipitation

3.2.1 Climate

Illinois is situated midway between the western Continental Divide and the Atlantic Ocean, and it is often underneath the ***polar jet-stream***, which creates low pressure systems that bring clouds, wind, and precipitation to the region. There are several other environmental factors that affect the climate of Illinois, including solar energy, the proximity of Lake Michigan, and urban areas. The intensity of the sun's incoming energy is determined by Illinois' mid-latitude position. This position causes Illinois to experience warm summers and cold winters, because the regional solar energy input is three to four times greater in the summer than in the winter. The presence and density of buildings, roads, parking lots, and industrial activities also influence the climate in comparison to surrounding rural areas, often increasing the temperature (National Climatic Data Center, 2009).

Locally, Lake Michigan influences the climate of Illinois, including the Buffalo Creek Watershed. Lake Michigan's large thermal mass moderates both the heat of the summer and the cold of the winter. Weather data also suggests that Lake Michigan increases general area cloudiness and decreases summer precipitation. During the winter, Lake Michigan enhances precipitation totals by adding lake-effect snow, which occurs when winds originate from the north or northeast (National Climatic Data Center, 2009).

Data obtained from the ***National Climatic Data Center*** (Barrington station) best represents the overall climate and weather patterns experienced in the Buffalo Creek Watershed. The 1981 to 2010 Climate Normals are the National Climatic Data Center's latest three-decade averages of climatological variables, including temperature and precipitation. The Climate Normals show that winter months are cold, averaging 23.5°F; and winter lows average 15.8°F. Summers are warm, averaging 70°F; and summer highs average 79.5°F. The Climatic Normals for temperature can be found in Figure 3-3.

3.2.2 Precipitation

Illinois exhibits a wide variability in annual precipitation. January and February are normally the driest months, while May and August are typically the wettest months. The Climatic Normals for precipitation can be found in Figure 3-4. The wide variety of climate conditions creates diverse watershed conditions. For example, during the winter months the watershed experiences

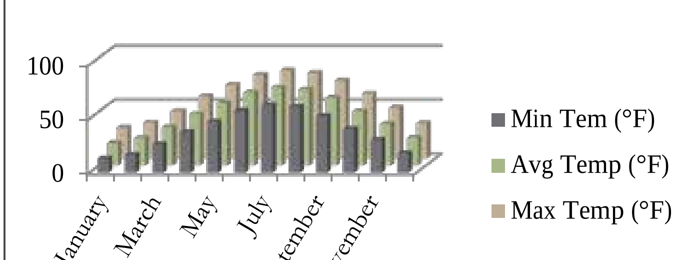
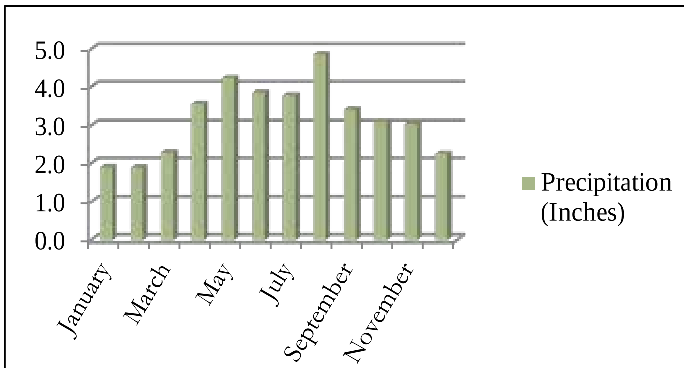


Figure 3-3: National Climatic Data Center's 1981-2010 Climate Normals – Temperature (Barrington, IL station).



precipitation in the form of snow; however, this precipitation minimally affects flooding. Snow melt in the spring, combined with rain events, may result in stream and localized flooding. During the spring the watershed will usually experience warming temperatures and wet weather conditions. In contrast, during the fall, the watershed experiences cooling temperatures and precipitation frequency decreases.

3.3 Soils

Deposits left during the last period of glaciation approximately 14,000 years ago are the raw materials of present soil types in the Buffalo Creek Watershed. A combination of physical, biological, and chemical variables, such as topography, drainage patterns, climate, erosion, and vegetation, have interacted over centuries to form the variety of soils found in the watershed. These soils were formed under wetland, forest, and prairie plant communities, and they are identified by a name associated with each series or class of soils with similar characteristics. A ***soil series*** name generally is derived from a town or landmark in or near the area where the soil series was first recognized, although naming conventions vary by county.

Soils determine the water-holding capacity and include both the erosion potential and ***infiltration*** capabilities. Soil characteristics indicate the manner in which soils in a particular area will interact with water in the environment, and therefore are useful in watershed planning. In particular, these soil characteristics can help to guide where restoration and best management practices are likely to be successful and where there may be constraints to project implementation.

The USDA NRCS has produced a detailed soil survey for Lake and Cook Counties. These soil surveys contain information regarding the physical and chemical properties as well as information regarding human use for each soil series and ***soil phase*** in Lake and Cook Counties. The soil surveys were utilized to extract detailed soil data for the Buffalo Creek Watershed.

Hydric Soils: *A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. These conditions alter the physical, biological and chemical characteristics of the soil, thereby influencing the species composition or growth, or both, of plants on those soils.*

Hydrophytic Vegetation: *Plant life growing in water, soil or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; one of the indicators of a wetland.*

Soil series: *A group of soils that have profiles which are almost alike, except for differences in texture of the surface layer. All soils of a series have horizons that are similar in composition, thickness, and arrangement.*

Infiltration: *That portion of rainfall or surface runoff that moves downward into the subsurface soil.*

Soil phase: *A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.*

Fifty-five different soil series have been identified throughout the watershed based on soil series coverage area as determined by the NRCS's Soil Survey of Lake County (NRCS 2012) and the NRCS's Soil Survey of Cook County (NRCS 2011). These soil types are symbolized on Figure 3-5. Of the 55 different soil series, only the 30-most dominant have been listed in Table 3-2. The remaining 25 soils have been classified as "non-dominant soils." Combined, non-dominant soils cover approximately 6% of the entire watershed. Markham silt loam is the predominant soil type in the watershed, covering approximately 2,436 acres or approximately 14% of the watershed. The Markham silt loam soil type is a very deep and moderately well drained soil of the till plains. Ashkum silty clay loam soils are the next most dominant soil series covering approximately 2,066 acres or approximately 12% of the watershed. The Ashkum silty clay loam soil type is a very deep and poorly drained soil of the till plains.

Table 3-2: Major Soil Types in the Buffalo Creek Watershed.

Soil Series	Soil Series Name	Acres	Hydrologic Soil Group (HSG)	Hydric Rating	% of Watershed
531	Markham silt loam	2,436	C	Not Hydric	14.00%
232A	Ashkum silty clay loam	2,066	C/D	Hydric	11.90%
530	Ozaukee silt loam	1,871	C	Not Hydric	10.80%
805B	Orthents, clayey	1,703	D	Not Hydric	9.80%
146	Elliott silt loam	1,238	C/D	Not Hydric	7.10%
223	Varna silt loam	645	C	Not Hydric	3.70%
298	Beecher silt loam	633	C/D	Not Hydric	3.60%
442B	Mundelein silt loam	531	B/D	Not Hydric	3.10%
153	Pella silt loam	438	B/D	Hydric	2.50%
984B	Barrington and Varna silt loams	424	B	Not Hydric	2.40%
854B	Markham-Ashkum-Beecher complex	415	C/D	Partially Hydric	2.40%
152A	Drummer silty clay loam	332	B/D	Hydric	1.90%
989	Mundelein and Elliott silt loams	327	B	Not Hydric	1.90%
189	Martinton silt loam	326	C	Not Hydric	1.90%
802B	Orthents, loamy	297	C	Not Hydric	1.70%
443B	Barrington silt loam	255	C	Not Hydric	1.50%
903A	Muskego and Houghton mucks	238	C/D	Hydric	1.40%
293A	Andres silt loam	205	C/D	Not Hydric	1.20%
541B	Graymont silt loam	201	C	Not Hydric	1.20%
294B	Symerton silt loam	195	C	Not Hydric	1.10%
979B	Grays and Markham silt loams	191	B	Not Hydric	1.10%
530	Ozaukee silty clay loam	189	C	Not Hydric	1.10%
330A	Peotone silty clay loam	188	C/D	Hydric	1.10%
103A	Houghton muck	175	A/D	Hydric	1.00%
3107A	Sawmill silty clay loam	165	B/D	Hydric	0.90%
978	Wauconda and Beecher silt loams	148	B	Not Hydric	0.90%
1107A	Sawmill silty clay loam, undrained	147	B/D	Hydric	0.80%
1103A	Houghton muck, undrained	136	A/D	Hydric	0.80%
848B	Drummer-Barrington-Mundelein complex	132	B/D	Partially Hydric	0.80%
531D2	Markham silt loam	34	C	Not Hydric	0.20%
	TOTAL	16,281 acres		93.8%	

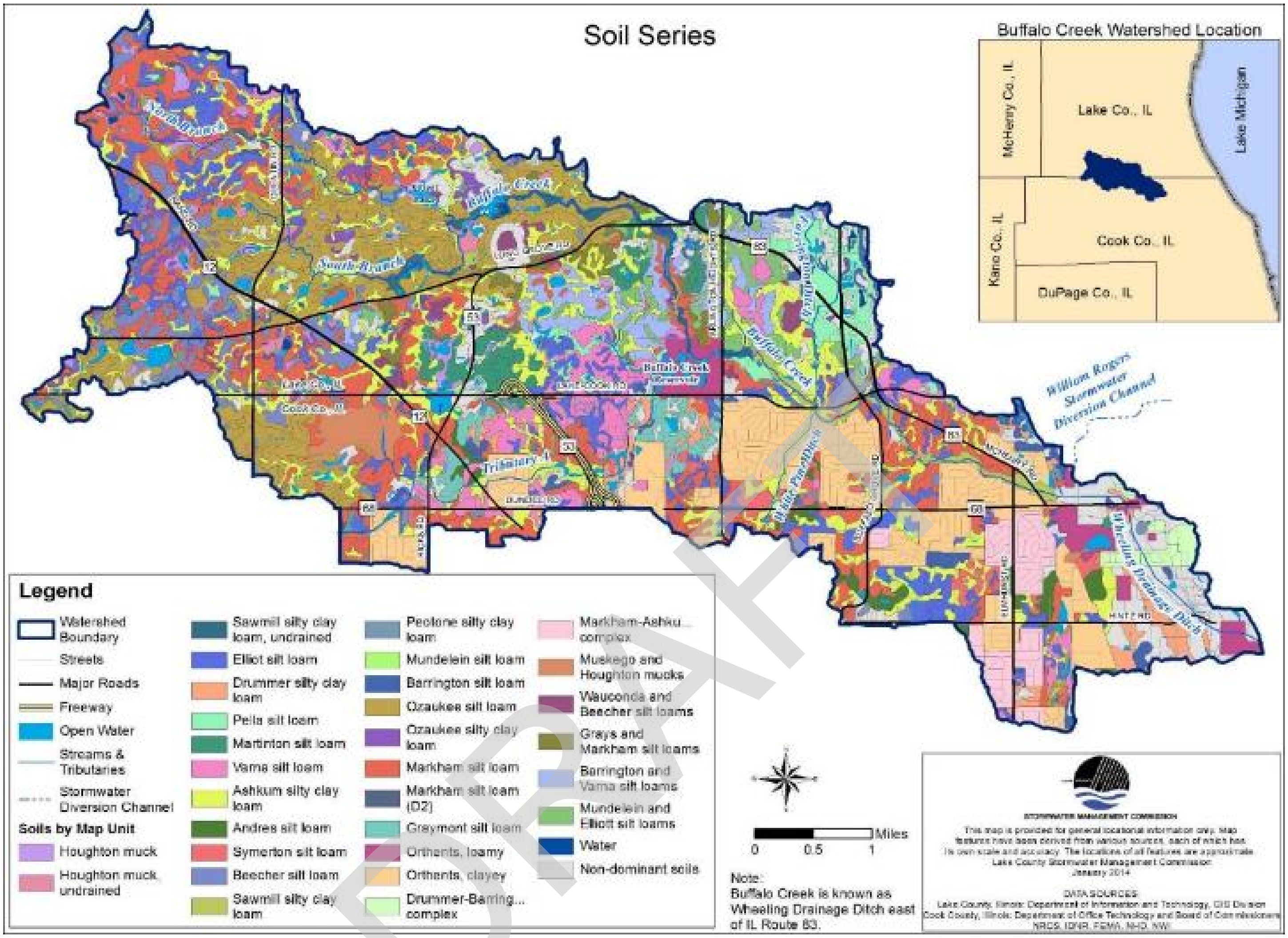


Figure 3-5: Major Soil Types in the Buffalo Creek Watershed.

3.3.1 Hydric Soils

Hydric soils form in areas of the landscape that are seasonally or permanently saturated with water. These conditions are conducive to the growth of ***hydrophytic vegetation***, or plants that tolerate or require saturated soil or standing water. Therefore, the presence of hydric soils is indicative of present or historical wetland conditions or may indicate depressional areas. Areas with hydric soils and drained hydric soils that do not presently contain wetlands may be candidates for wetland restoration.

Figure 3-6 maps hydric soils in the Buffalo Creek Watershed, according to the NRCS 2012 Lake County Soil Survey and 2011 Cook County Soil Survey. Hydric soils are listed in Table 3-3 and comprise approximately 4,650 acres (27%), while non-hydric soils comprise 12,743 acres (73%) of the watershed. Most of the streams, lakes, and other surface waters in the watershed have hydric soils associated with them. Additionally, smaller pockets of hydric soils are well-distributed throughout the watershed.

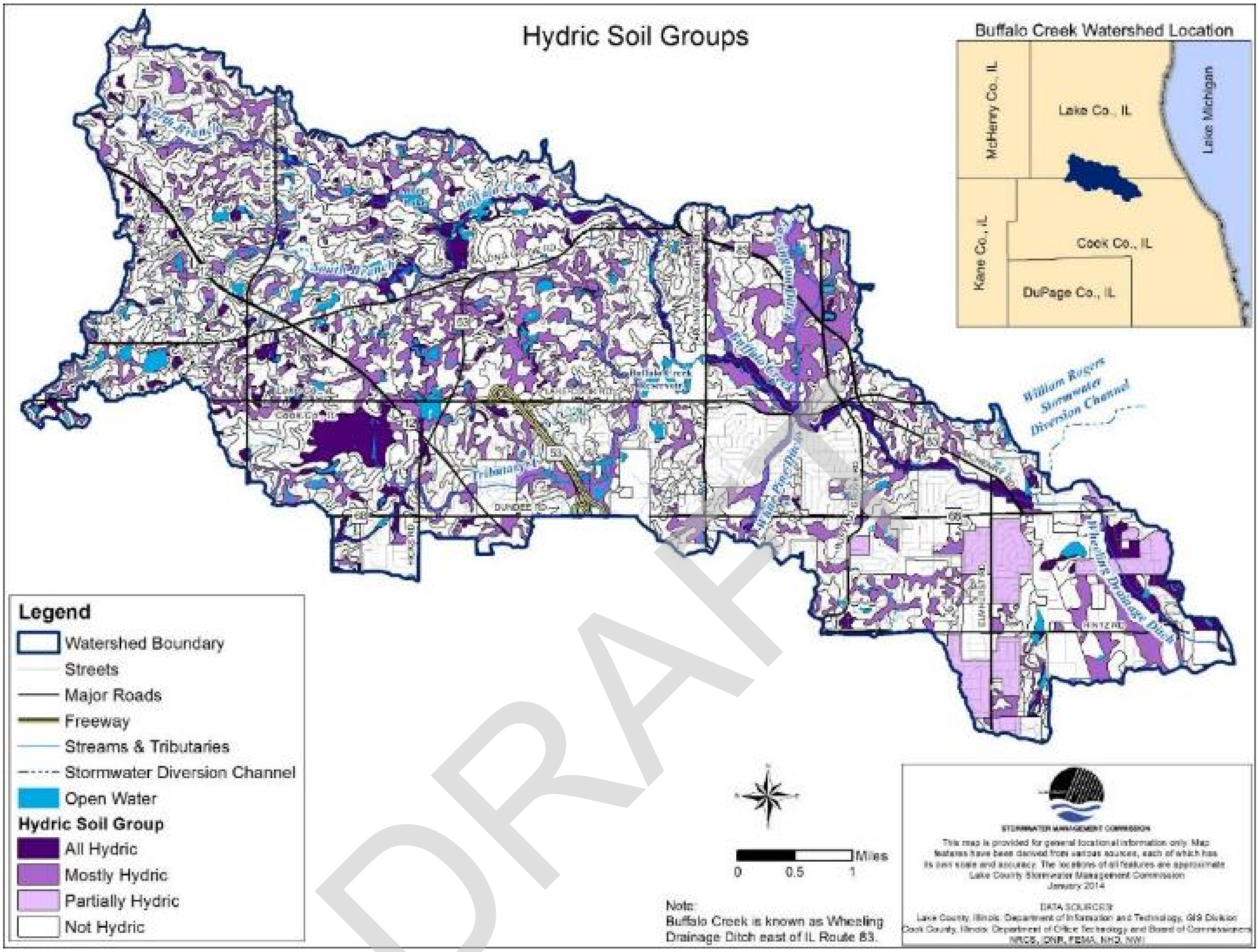


Figure 3-6: Hydric Soil in the Buffalo Creek Watershed.

Table 3-3: Hydric Soils in the Buffalo Creek Watershed.

Soil Series Name	Area (Acres)	% of Watershed
Houghton muck, undrained, 0 to 2 percent slopes	136	0.80%
Sawmill silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded	147	0.80%
Selma loam, 0 to 2 percent slopes	37	0.20%
Muskego and Houghton mucks, undrained, 0 to 2 percent slopes	3	0.00%
Bryce silty clay, 0 to 2 percent slopes	4	0.00%
Sawmill silty clay loam, 0 to 2 percent slopes, frequently flooded	165	0.90%
Will silty clay loam, 0 to 2 percent slopes	73	0.40%
Peotone silty clay loam, 0 to 2 percent slopes	188	1.10%
Muskego and Peotone soils, ponded, 0 to 2 percent slopes	14	0.10%
Harpster silty clay loam, 0 to 2 percent slopes	8	0.00%

Muskego and Houghton mucks, 0 to 2 percent slopes	238	1.40%
Houghton muck, 0 to 2 percent slopes	175	1.00%
Peotone silty clay loam, undrained, 0 to 2 percent slopes	32	0.20%
Drummer silty clay loam, 0 to 2 percent slopes	332	1.90%
Pella silty clay loam, 0 to 2 percent slopes	426	2.40%
Pella silt loam, 0 to 2 percent slopes, overwash	12	0.10%
Ashkum silty clay loam, 0 to 2 percent slopes	2,066	11.90%
Houghton muck, ponded, 0 to 2 percent slopes	44	0.30%
Granby fine sandy loam, 0 to 2 percent slopes	3	0.00%
Drummer-Barrington-Mundelein complex, 1 to 6 percent slopes	132	0.80%
Markham-Ashkum-Beecher complex, 1 to 6 percent slopes	415	2.40%
TOTAL	4,650	27%

3.3.2 Hydrologic Soil Groups

NRCS broadly classified soils based on their drainage characteristics, into four different ***Hydrologic Soil Groups (HSG)***. The classification considers soil texture, drainage description, runoff potential, infiltration rate, and transmission rate (permeability). Group A is comprised of the most permeable soil types (i.e. sandy soils) and has the least runoff potential while group D includes the most impermeable soil types (i.e. clay) and has the greatest runoff potential. HSGs should be considered when identifying potential stormwater best management practice and retrofit opportunities.

The main HSGs are separated into four categories: A, B, C, and D. HSG permeability and surface runoff characteristics are defined as follows:

Group A, due to high infiltration rates, have low total surface runoff potential. These soils are composed mainly of deep, well drained sands and gravels. These soils have high water transmission rates (greater than 0.30 in/hour)

Group B have low to moderate runoff potential with moderate infiltration rates and consist of moderately coarse to moderately fine textures. These soils have moderate water transmission rates (0.15-0.30 in/hour).

Group C have moderate to high surface runoff potential with slow infiltration rates. They chiefly consist of soils with layers that impede the downward movement of water. Their textures are fine to moderately fine. These soils have a low water transmission rate (0.05-0.15 in/hour).

Group D have the greatest runoff potential with very slow infiltration rates. They consist chiefly of clay soils with high water tables and shallow soils over nearly ***impervious materials***. These soils have a very low water transmission rate (0-0.05 in/hour).

There are also areas with combined soil groups: HSG-A/B, HSG-A/D, HSG-B/D, and HSG-C/D. These combined soil groups are a combination of soil types and exhibit a combination of permeability and surface runoff characteristics. The soil characteristics can change depending on saturation, slope, and time of year. If these soils can be adequately drained (with underground drain tiles or

Hydrologic Soil Groups: *Groupings of soils according to their runoff potential.*

Runoff Curve Numbers: *An empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall. Runoff curve numbers have range from 0 to 100; lower numbers indicate low runoff potential while larger numbers are for increasing runoff potential. The lower the curve number, the more permeable the soil is.*

Impervious Materials: *The total area of rooftops, pavement, and other compacted or hard surfaces that prevent infiltration of precipitation into the ground and therefore result in the generation of surface runoff from nearly all precipitation events).*

Impervious Surfaces: *The total area of rooftops, pavement, and other compacted or hard surfaces that prevent infiltration of precipitation into the ground and therefore result in the generation of surface runoff from nearly all precipitation).*

other techniques), then they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the un-drained condition.

Runoff curve numbers classify the runoff potential of different soil types with different types of land cover. The curve numbers are a function of HSGs, land cover or usage, and antecedent soil moisture conditions. The curve number value can be a number from 0 to 100. Lower runoff curve numbers indicate low runoff potential, while larger runoff curve numbers indicate increased runoff potential. A runoff curve number of 98 is representative of typical ***impervious surfaces***.

Overall, soils in the Buffalo Creek Watershed are not well drained, as shown in Figure 3-7 and Table 3-4. No soils are classified in hydrologic soil group "A," or well-drained soils. Soils classified in hydrologic soil group "B" comprise 8% of the watershed, and are characterized as "moderately well drained" relative to other soil types. More than 50% of the Buffalo Creek Watershed is covered by surface water or soils in hydrologic groups "C" and "D," which exhibit "slow" and "very slow" infiltration and transmission rates, relative to other soil types.

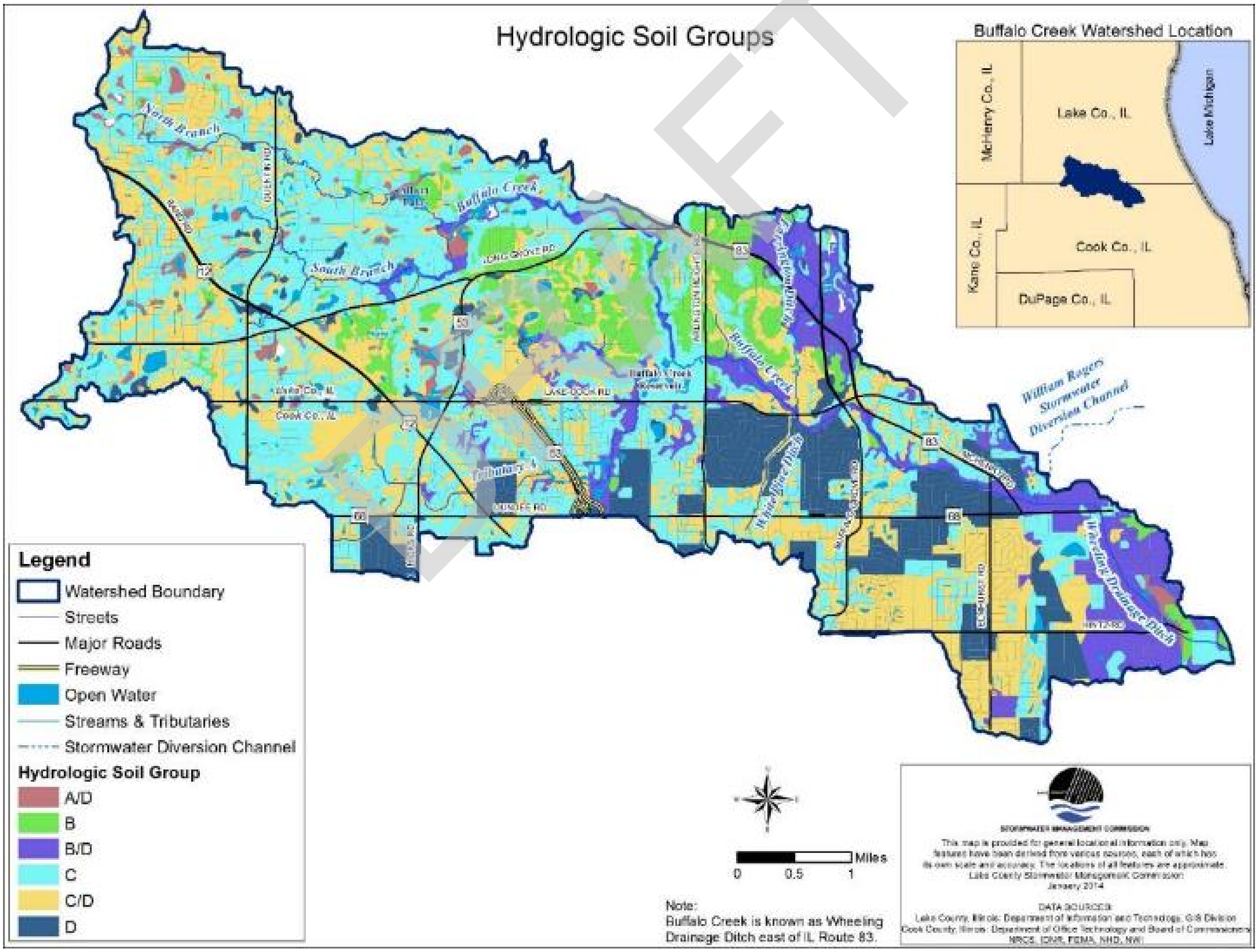


Figure 3-7: Hydrologic Soil Groups in the Buffalo Creek Watershed.

Table 3-4: Hydrologic Soil Groups in the Buffalo Creek Watershed.

Hydrologic Soil Group	Area (Acres)	% of Watershed
A/D	344	2%
B	1,349	8%
B/D	1,847	11%
C	6,434	37%
C/D	5,129	29%
D	1,927	11%
Open Water	363	2%
TOTAL	17,393	100.0%

3.3.3 Soil Erodibility

Soil erodibility is largely determined by the tendency of soil particles to become detached and mobilized by water and the ground slope. Highly erodible soils in the watershed are highly susceptible to erosion by water due to a combination of slope, particle size, and cohesion, but they are not prone to erosion by wind. Highly erodible soils are considered in the watershed plan because erosion from these soils can potentially end up in surface waters, contributing to high amounts of total suspended solids and sediment accumulation in streams and lakes. This results in degradation of water quality due to silt and sediment deposition and pollution. The movement or loss of soil resulting from erosion may also cause damage to property as buildings and infrastructure are undermined. The removal and disposal of sediment accumulated in lakes, ponds, detention ponds and the storm drainage system can be expensive from a public works maintenance perspective.

In the Buffalo Creek Watershed, 10,625 acres (61%) are classified as having highly erodible soil. This suggests that a significant amount of the soils in the watershed have the potential to contribute to water quality issues. Figure 3-8 maps the locations of highly erodible soils within the Buffalo Creek Watershed, and Table 3-5 summarizes the highly erodible soils present in the watershed. Highly erodible soils do not include any hydric soils and are represented by hydrologic soil groups “B” and “C,” described as moderately poor to moderately well-drained soils. Erodible soils along lakeshores and stream channels and on disturbed land surfaces (e.g. active crop lands and construction sites) are most susceptible to erosion. A large portion of the highly erodible soils in the Buffalo Creek Watershed are associated with open water (see Figure 3-8). Therefore, stabilization practices near shorelines and stream channels could reduce erosion. Additionally, land developers are required to follow the National Pollutant Discharge Elimination System (NPDES) and the Lake County Watershed Development Ordinance (WDO) regulations regarding soil erosion and sediment control measures during construction.

Noteworthy: Soil Erodibility and Pollution

Soil characteristics, especially the tendency of soil particles to become detached and mobilized by water runoff, have considerable impact on water quality. For instance, sandy soils are more prone to erosion than clayey soils, although pollutants are more likely to be attached to clay particles. It is important to map highly erodible soils because they represent areas that may contribute large amounts of total suspended solids (TSS) to streams and lakes. High TSS levels can result in stream degradation as a result of silt deposition and pollution. Some pollutants frequently attach to TSS particles and wash into lakes and streams, polluting the water and sediments and decreasing water clarity.

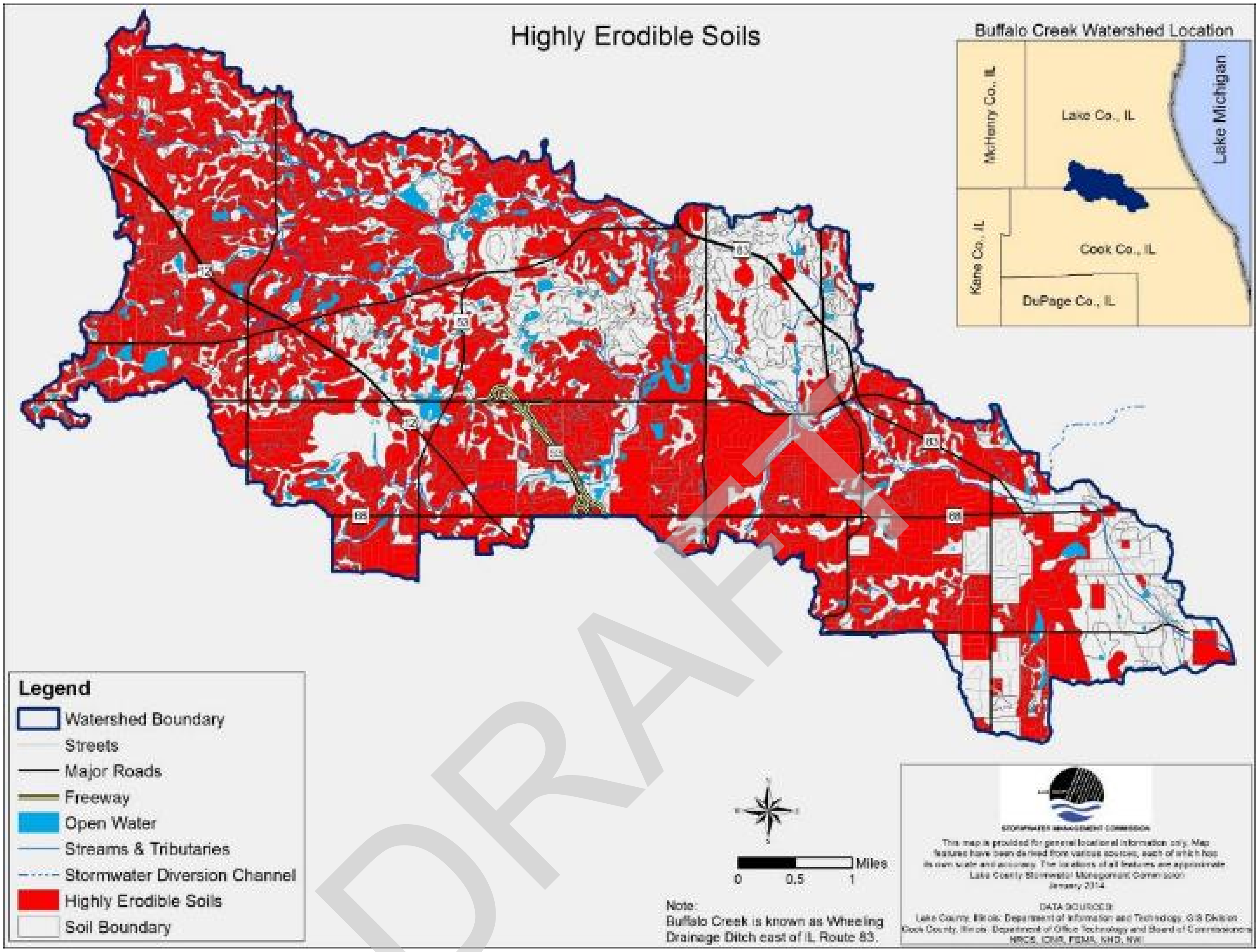


Figure 3-8: Highly Erodible Soils in the Buffalo Creek Watershed.

Table 3-5: Highly Erodible Soils in the Buffalo Creek Watershed.

Major Highly Erodible Soil Series Name	Area (Acres)	% of Watershed
Symerton silt loam	195	1.10%
Ozaukee silty clay loam	189	1.10%
Graymont silt loam	201	1.20%
Andres silt loam	205	1.20%
Barrington silt loam	255	1.50%
Orthents, loamy	297	1.70%
Martinton silt loam	326	1.90%
Beecher silt loam	633	3.60%
Varna silt loam	645	3.70%
Elliott silt loam	1,238	7.10%
Orthents, clayey	1,703	9.80%

Ozaukee silt loam	1,871	10.80%
Markham silt loam	2,436	14.00%
Minor Series (Swygert, Saylesville, Markham, Chenoa, Zurich, Grays, Blount)	333	1.9%
TOTAL	10,625	61%

3.4 Watershed Jurisdictions

3.4.1 Watershed Planning and Political Boundaries

The Buffalo Creek Watershed has numerous political jurisdictions, including municipal, township, and other local, state, and federal elective and agency jurisdictions. The boundaries of these jurisdictions are seldom drawn to coincide with watershed boundaries.

Eight-five percent of the Buffalo Creek Watershed is incorporated, within nine municipalities. The Village of Wheeling occupies the largest area of any municipality within the watershed, at nearly 3,041 acres, or almost 17% of the total watershed area, and the Villages of Buffalo Grove and Long Grove each occupy approximately 16% of the watershed. Unincorporated areas of Lake County total 986 acres (approximately 5% of the watershed) and unincorporated areas of Cook Counties total 1,074 acres (approximately 6% of the watershed). ***Incorporated*** and ***unincorporated*** areas are shown in Figure 3-9 and Table 3-6.

One of the challenges of watershed planning, and implementing a watershed plan, is that a watershed usually includes multiple jurisdictions that have varying interests, resources, and responsibilities. This variability can be positive if the jurisdictions actively work together to collaborate on policies, projects, and practices, but frequently it presents watershed coordination challenges for efficiently implementing Best Management Practices (BMP) projects and for providing program, policy, and regulatory consistency. In some cases independent actions by one community or jurisdiction can have a negative impact on watershed neighbors, or a good project may not be as effective as it could have been if resources had been pooled to expand the scope of the project to cover a broader area of the watershed, thereby providing economies of scale.

Incorporated: *Land that is part of a municipality and is subject to its taxation and services.*

Unincorporated: *Land that is not part of a municipality and is not subject to its taxation and services.*

Watershed planning brings communities together to protect and improve the land and water resources that they share and impact. Watershed activities and projects offer many opportunities for communities and other government agencies to operate outside of their traditional "silos." When communities meet regularly as a watershed group, it provides opportunities to share information and coordinate activities. For instance, when a community or agency develops or updates a comprehensive plan, disagreement and costly competition among agencies/jurisdictions can be averted if the watershed plan and the plans of neighboring communities and sister agencies (such as parks departments or districts) are considered. This level of coordination will benefit the watershed as a whole. As an example, a municipality may receive a development proposal for a land parcel that the local parks department has identified as environmentally sensitive and has included in their long-range conservation plan for the community. Although the underlying zoning for the land may allow the proposed development, both the community and the developer are likely going to face challenges from competing interests, and with land development standards so that it does not negatively impact whatever feature made it environmentally sensitive. Sharing information about the land during the comprehensive planning process can avert these kinds of problems down the road.

Table 3-6: Municipalities within the Buffalo Creek Watershed.

Jurisdictional Body	Acres in Lake County	Acres in Cook County	Total Acres	% of Watershed
Wheeling	26	3,267	3,293	18.93%
Buffalo Grove	1,536	1,259	2,795	16.07%
Long Grove	2,518	0	2,518	14.48%
Kildeer	1,723	0	1,723	9.91%
Palatine	0	1,491	1,491	8.57%
Lake Zurich	1,418	0	1,418	8.15%
Deer Park	1,165	9	1,174	6.75%
Arlington Heights	0	920	920	5.29%
Forest Preserve District of Cook County	0	640	640	3.68%
Ela Township	546	0	546	3.14%
Lake County Forest Preserve District	437	0	437	2.51%
Palatine Township	0	166	166	0.95%
Prospect Heights	0	207	207	1.19%
Wheeling Township	0	61	61	0.35%
Vernon Township	3	0	3	0.02%
Total	9,372	8,020	17,393	100

3.4.2 Lake County Jurisdictions

The Lake County portion of the Buffalo Creek Watershed has 9,372 acres of the 17,393 total acres and includes the townships of Ela and Vernon and the municipalities of Arlington Heights, Buffalo Grove, Deer Park, Kildeer, Lake Zurich, Long Grove, and Wheeling. Additional Illinois jurisdictional bodies that are located in the watershed are shown in Figure 3-9 through Figure 3-13 and Table 3-7 and include:

1. Lake County Board Districts (19th District, 20th District)
2. Lake County Forest Preserve District (LCFPD)
3. Park Districts (Arlington Heights, Barrington, Buffalo Grove, Long Grove, Wheeling)
4. Illinois State Representative Districts (51st District, 57th District, 59th District)
5. Illinois State Senatorial Districts (26th District, 29th District, 30th District)
6. US Congressional Districts (10th District, 6th District)

There is public and private shared responsibility for management, regulation, and protection of watersheds in Lake County. The Lake County WDO is applied county-wide by municipal and county governments to provide consistent development standards for development and redevelopment that could affect water resources within incorporated and unincorporated areas. Incorporated areas are responsible for land use planning, zoning, permitting and enforcement for development within their jurisdictions. Development activities in unincorporated areas are permitted and enforced by the Lake County Planning, Building and Development Department (LCPB&D) utilizing the Unified Development Ordinance (UDO).

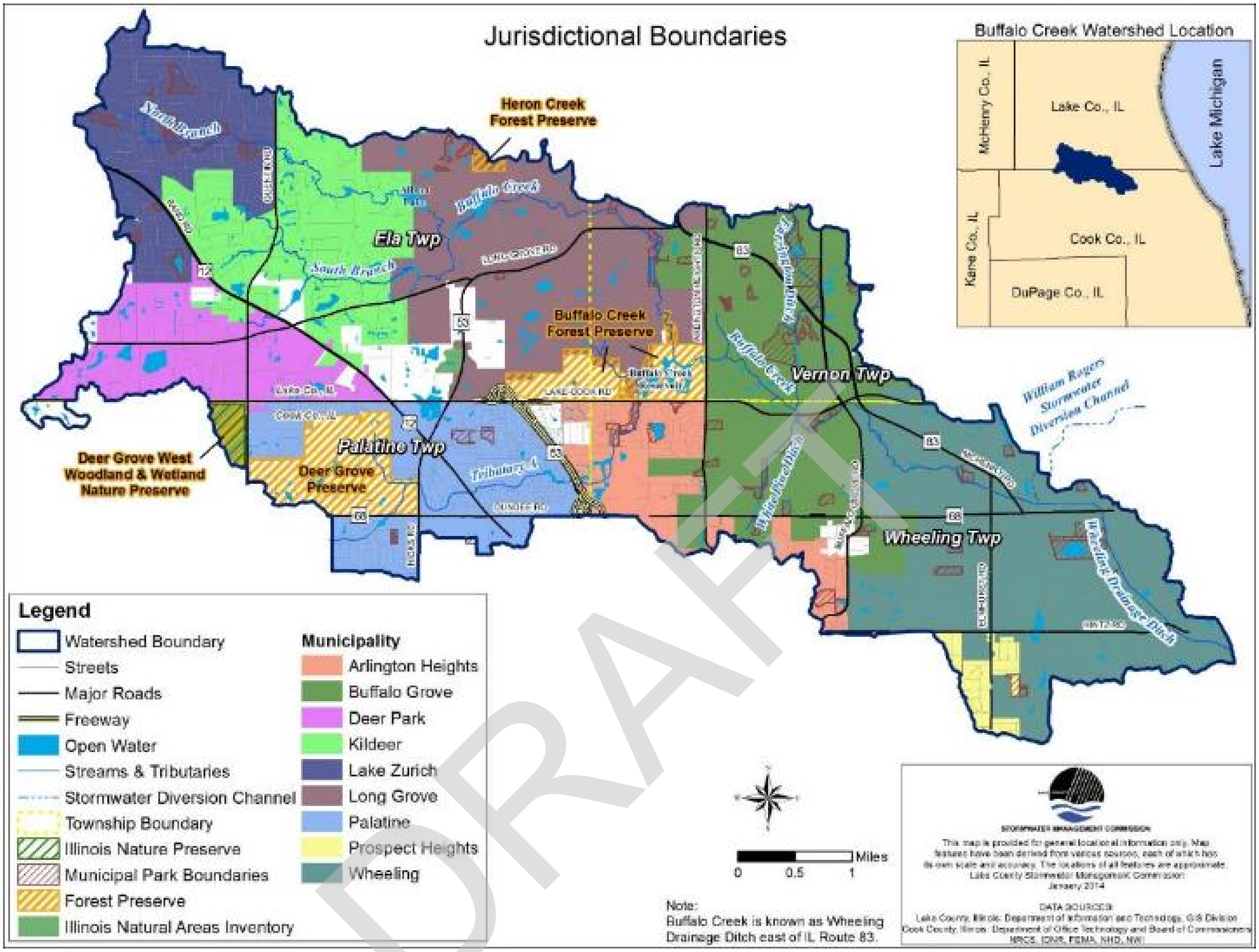


Figure 3-9: Jurisdictional Boundaries in the Buffalo Creek Watershed.

3.4.3 Cook County Jurisdictions

The Cook County portion of the watershed has 8,020 acres of the 17,393 total acres and includes the townships of Palatine and Wheeling and the municipalities of Arlington Heights, Buffalo Grove, Deer Park, Palatine, Prospect Heights, and Wheeling. These municipalities are responsible for land use planning, zoning, permitting, and enforcement for development within their jurisdictions. Additional Illinois jurisdictional bodies that are located in the watershed are shown in Figures 3-9 through 3-13 and Table 3-8 and include:

1. Cook County Forest Preserve District
2. Park Districts (Arlington Heights, Barrington, Buffalo Grove, Palatine, Prospect Heights, Wheeling)
3. Illinois State Representative Districts (53rd District, 54th District, 57th District, 59th District)
4. Illinois State Senatorial Districts (27th District, 29th District, 30th District)
5. US Congressional Districts (6th District, 8th District, 9th District, 10th District)

There is public and private shared responsibility for management, regulation, and protection of watersheds in Cook County. The Cook County Watershed Management Ordinance (WMO) is applied county-wide (excluding the City of Chicago) by the MWRD. The purpose of the WMO is to abate the negative impacts of stormwater runoff (e.g. flooding, erosion, water quality impairments, etc.) from new upstream developments or redevelopments.

Table 3-7: Jurisdictional Bodies in the Lake County Portion of the Buffalo Creek Watershed.

Jurisdiction Body	Acres	% of Watershed	% of County
Lake County	9,372.3	53.9%	100.0%
Municipalities			
Buffalo Grove	1,535.7	8.8%	16.4%
Deer Park	1,165.9	6.7%	12.4%
Kildeer	1,723.0	9.9%	18.4%
Lake Zurich	1,417.9	8.2%	15.1%
Long Grove	2,518.2	14.5%	26.9%
Wheeling	25.7	0.1%	0.3%
Unincorporated	986.0	5.7%	10.5%
Total	9,372.3	53.9%	100.0%
Townships			
Ela Township	6,871.0	39.5%	73.3%
Vernon Township	2,510.0	14.4%	26.8%
Total	9,381.0	53.9%	100.1%
U.S. Congressional Districts			
10th Congressional District	2,512.0	14.4%	26.8%
6th Congressional District	6,865.0	39.5%	73.2%
Total	9,377.0	53.9%	100.0%
State Representative Districts			
State Representative District - 51st	7,813.0	44.9%	83.4%
State Representative District - 57th	596.0	3.4%	6.4%
State Representative District - 59th	967.0	5.6%	10.3%
Total	9,377.0	53.9%	100.0%
State Senate Districts			
State Senate District - 26th	7,813.0	44.9%	83.4%
State Senate District - 29th	596.0	3.4%	6.4%
State Senate District - 30th	967.0	5.6%	10.3%
Total	9,377.0	53.9%	100.0%
County Board Districts			
Lake County Board - 19th District	4,485.0	25.8%	47.9%
Lake County Board - 20th District	4,892.0	28.1%	52.2%
Total	9,377.0	53.9%	100.0%
Park Districts			
Arlington Heights Park District	15.0	0.1%	0.2%

Barrington Park District	1.0	0.0%	0.0%
Buffalo Grove Park District	1,675.0	9.6%	17.9%
Long Grove Park District	2,663.0	15.3%	28.4%
Wheeling Park District	24.0	0.1%	0.3%
Total	4,379.0	25.2%	46.7%

Table 3-8: Jurisdictional Bodies in the Cook County Portion of the Buffalo Creek Watershed.

Jurisdiction Body	Acres	% of Watershed	% of County
Cook County	8,020.4	46.1%	100.0%
Municipalities			
Arlington Heights	919.6	5.3%	11.5%
Buffalo Grove	1,259.0	7.2%	15.7%
Deer Park	8.6	0.0%	0.1%
Palatine	1,490.6	8.6%	18.6%
Prospect Heights	207.4	1.2%	2.6%
Wheeling	3,267.8	18.8%	40.7%
Unincorporated	867.4	5.0%	10.8%
Total	8,020.4	46.1%	100.0%
Townships			
Palatine Township	2,378.6	13.7%	29.7%
Wheeling Township	5,632.9	32.4%	70.3%
Total	8,011.6	46.1%	100.0%
U.S. Congressional Districts			
6th Congressional District	1,645.8	9.5%	20.5%
8th Congressional District	3,402.6	19.6%	42.5%
9th Congressional District	365.6	2.1%	4.6%
10th Congressional District	2,609.3	15.0%	32.6%
Total	8,023.3	46.1%	100.0%
State Representative Districts			
State Representative District - 53rd	169.4	1.0%	2.1%
State Representative District - 54th	1,762.5	10.1%	22.0%
State Representative District - 57th	4,730.7	27.2%	59.0%
State Representative District - 59th	1,361.6	7.8%	17.0%
Total	8,024.2	46.1%	100.0%
State Senate Districts			
State Senate District - 27th	1,932.0	11.1%	24.1%
State Senate District - 29h	4,730.7	27.2%	59.0%
State Senate District - 30th	1,361.6	7.8%	17.0%
Total	8,024.2	46.1%	100.0%
Park Districts			
Arlington Heights Park District	710.6	4.1%	8.9%
Barrington Park District	23.2	0.1%	0.3%

Buffalo Grove Park District	1,401.2	8.1%	17.5%
Palatine Park District	2,056.6	11.8%	25.7%
Prospect Heights Park District	270.1	1.6%	3.4%
Wheeling Park District	3,050.8	17.5%	38.1%
Total	7,512.5	43.2%	93.8%

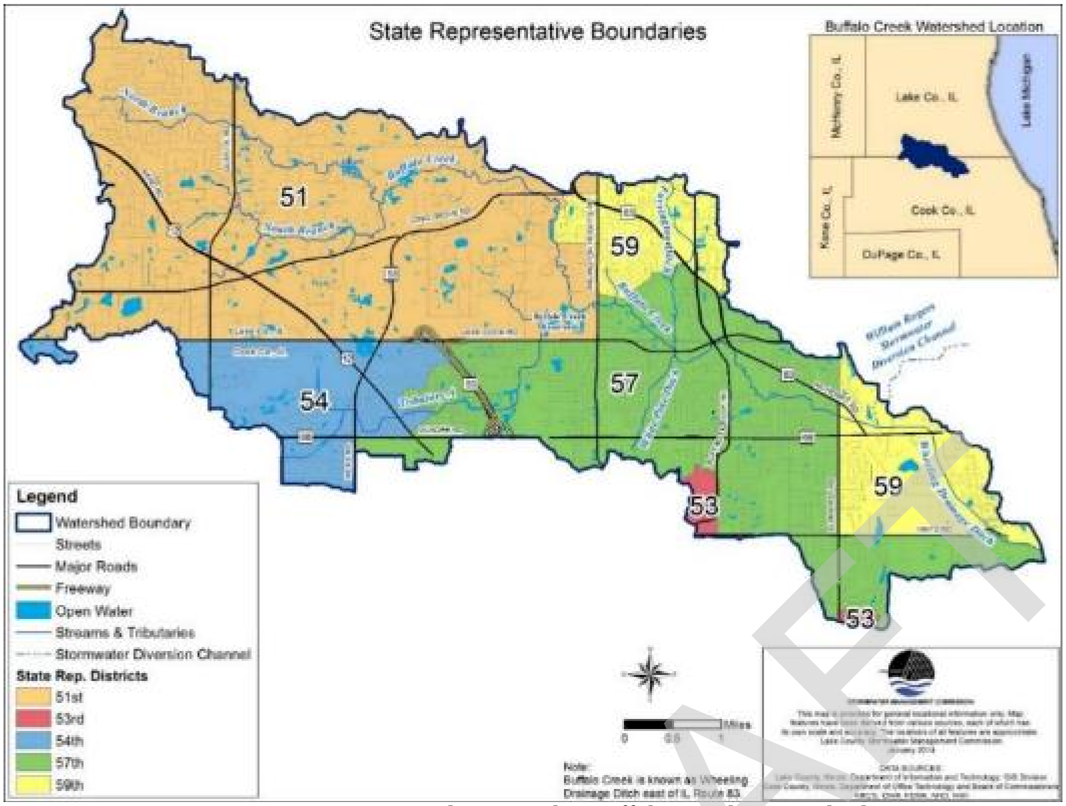


Figure 3-10: State Representative Boundaries in the Buffalo Creek Watershed.

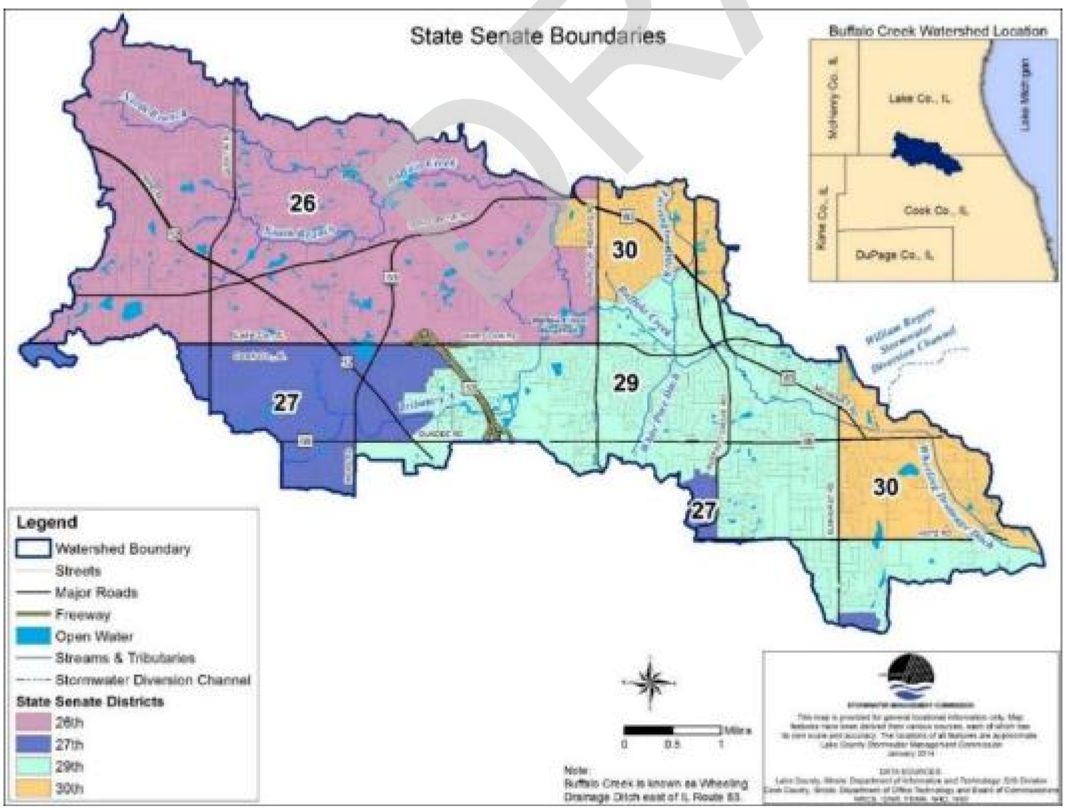


Figure 3-11: State Senate Boundaries in the Buffalo Creek Watershed.

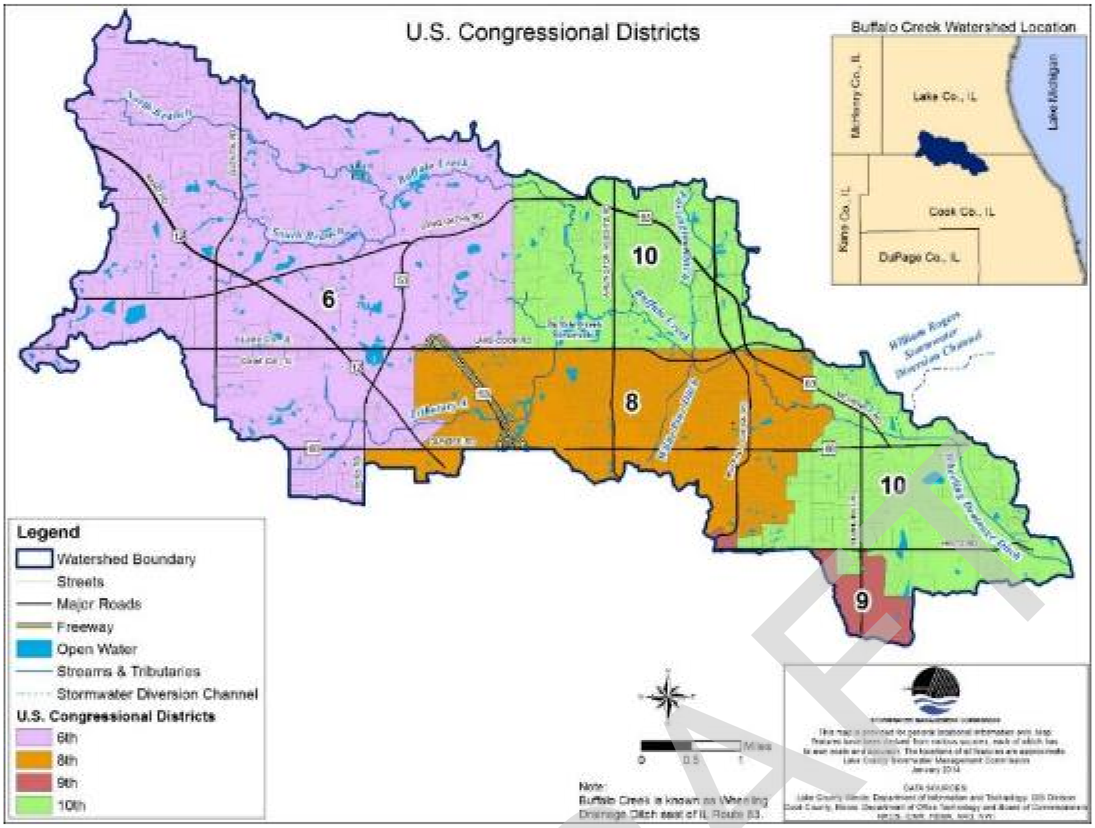


Figure 3-12: U.S. Congressional Districts in the Buffalo Creek Watershed.

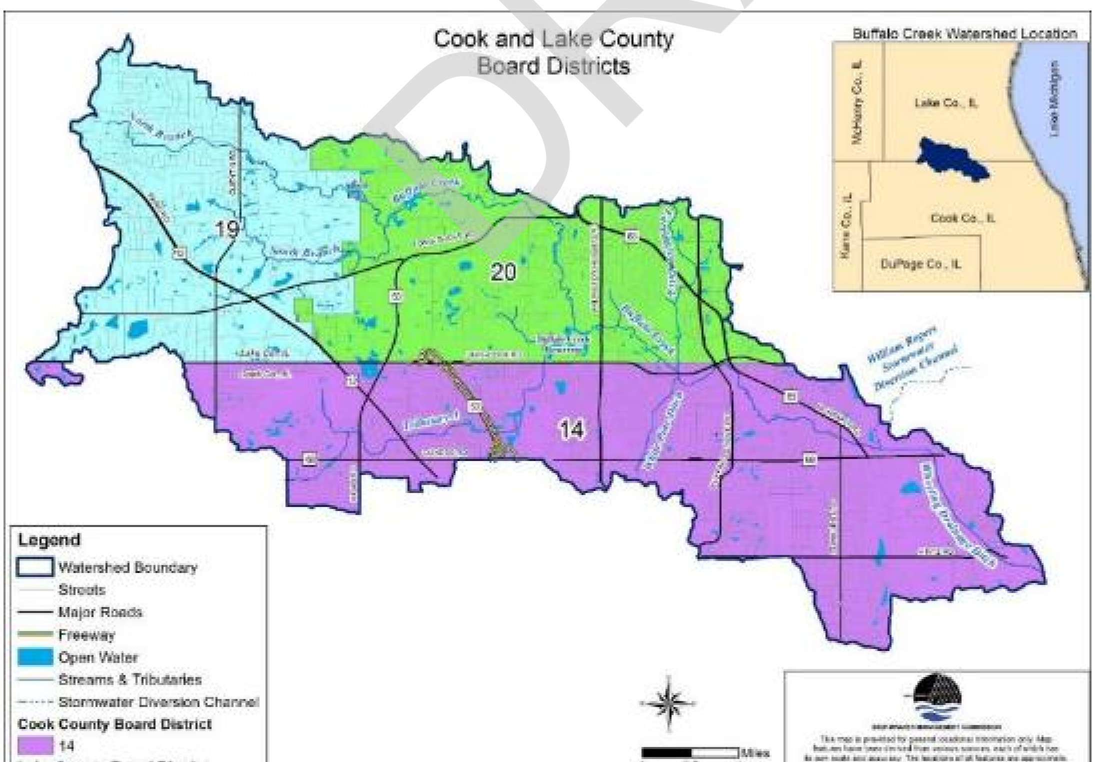


Figure 3-13: Cook and Lake County Board Districts in the Buffalo Creek Watershed.

3.5 Demographics

Based on the 2010 decennial census, the population within the Buffalo Creek Watershed is approximately 123,813. CMAP forecasts population to increase by an additional 23% by the year 2040 (see Figure 3-14 and Table 3-9). This population change is also expected to increase the number of homes in the watershed, especially in those areas where population growth is expected to increase the most (see Figure 3-15 and Table 3-9). As of 2010, there were approximately 55,348 jobs in the Buffalo Creek Watershed. CMAP forecasts employment to increase by 25.5% by the year 2040 (see Figure 3-16 and Table 3-9), similar to the ratio forecast for population growth. The CMAP population and employment forecast is based on a model that accounts for local future development and land use plans, as well as other land use, demographic, and economic variables and trends. Because the Buffalo Creek Watershed is a relatively small portion of the entire CMAP population forecast area, the results should be considered as an example or indicator of how the watershed could develop over the next few decades. This plan does not draw conclusions or recommendations from any single evaluation unit (square) in the forecast map.

Table 3-9: CMAP's 2040 Forecast Data for the Buffalo Creek Watershed.

	2010	2010 Density/acre	2040	2040 Density/acre	Forecast Change (2010-2040)	Percent Change (2010-2040)
Population	123,813	7.1	152,332	8.8	28,519	23.0%
Households	46,328	2.7	53,954	3.1	7,626	16.5%
Employment	55,348	3.2	69,479	4.0	14,131	25.5%

Source: Chicago Metropolitan Agency for Planning 2040 Forecasts

Noteworthy: Demographic Forecasts

To create demographic projections, regional agencies analyze data from local agencies for various demographic criteria, including population, households, and employment. After the data is collected from local governments, adjustments must be made to the data in situations where there is overlapping or contradictory information amongst the local jurisdiction boundaries. Forecasts are then projected for quarter sections, which are 160-acre tracts of land.

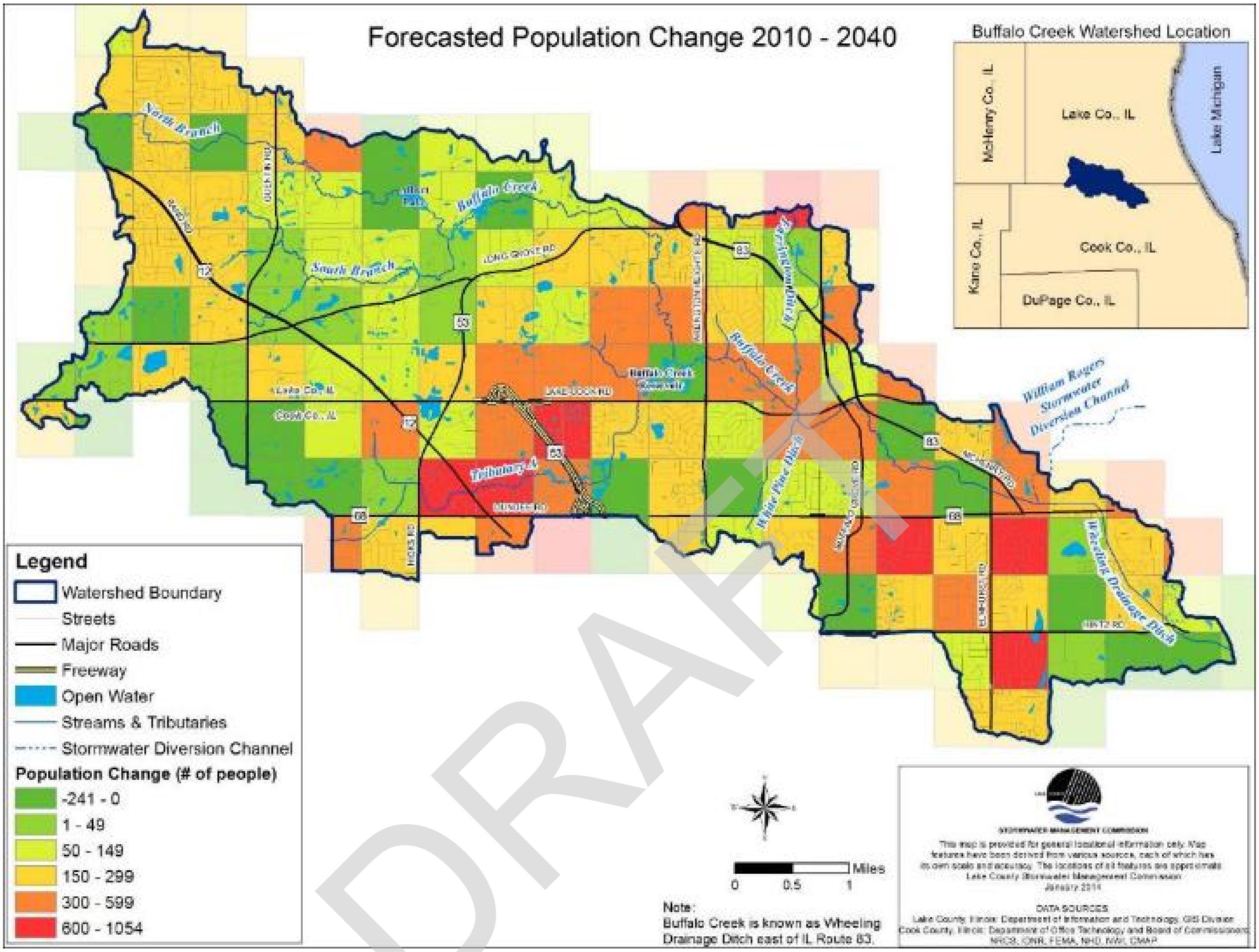


Figure 3-14: Forecasted Population Change in the Buffalo Creek Watershed.

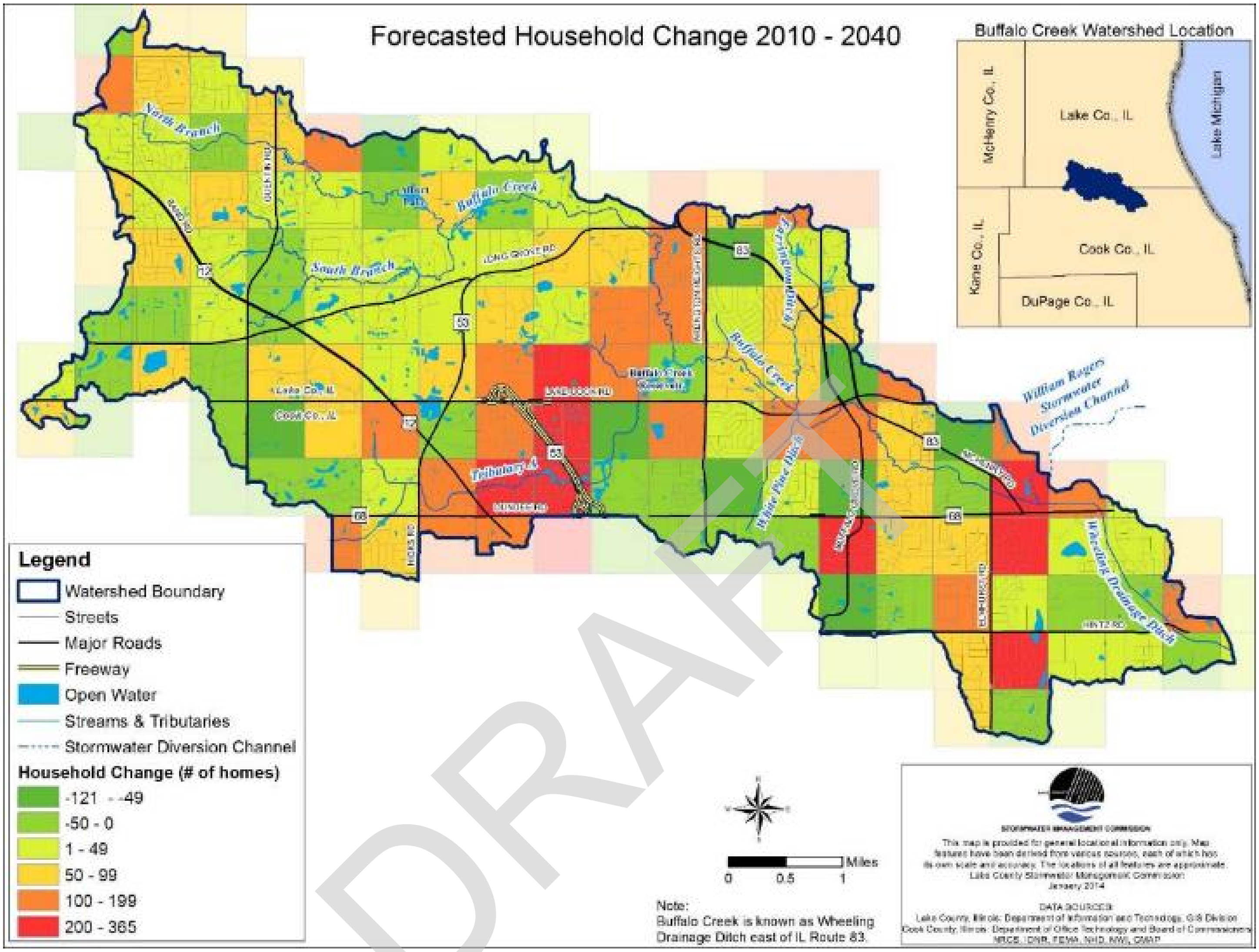


Figure 3-15: Forecasted Household Change (# of homes) in the Buffalo Creek Watershed.

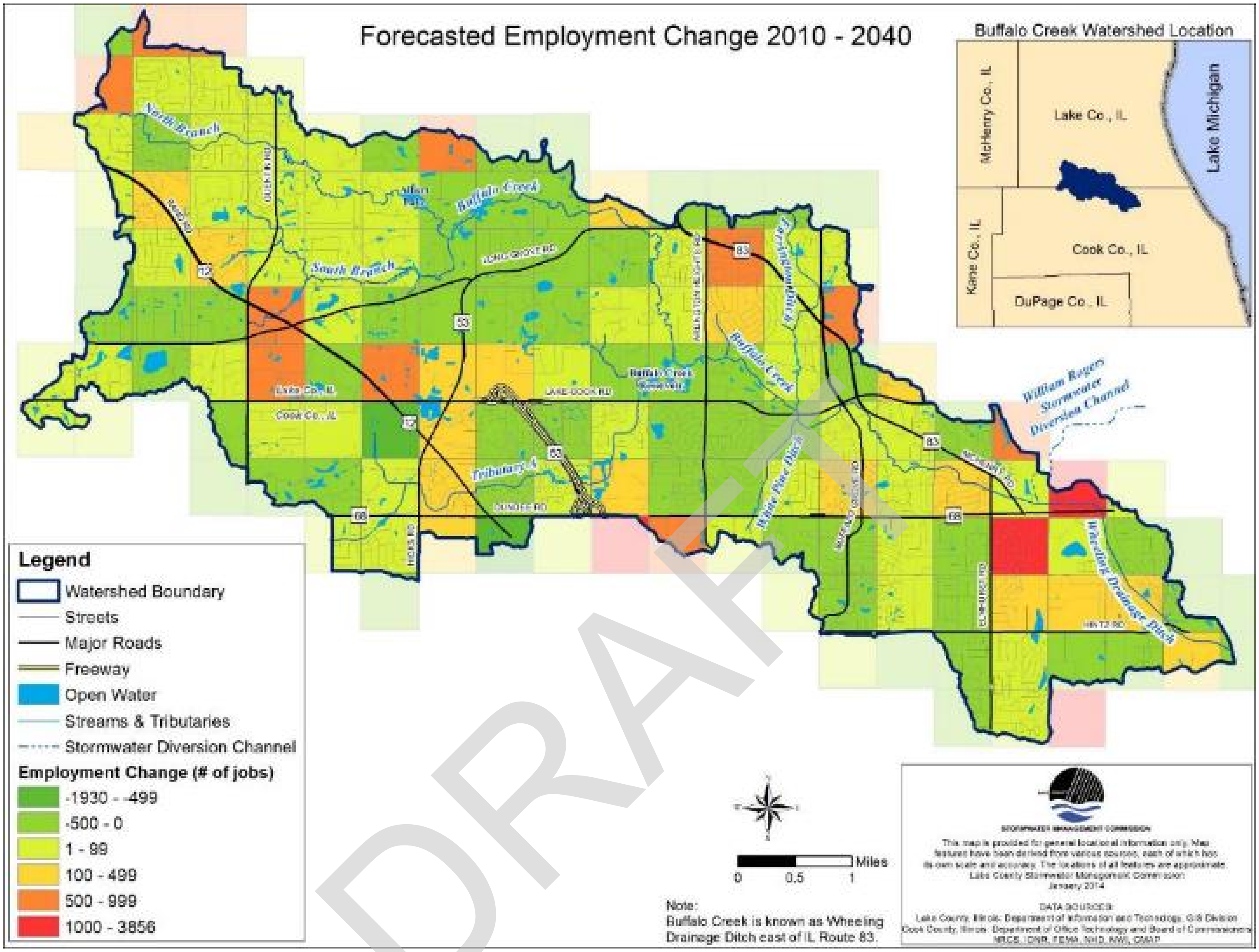


Figure 3-16: Forecasted Employment Change (# of jobs) in the Buffalo Creek Watershed.

3.6 Land Use and Land Cover

3.6.1 Historic Land Cover

Pre-settlement vegetation within the Buffalo Creek Watershed was evaluated in the Final Report Region 5 Wetland Management Opportunities and Marketing Plan: Select Watersheds in the Lower Fox and Des Plaines River Watersheds (R5WMO) by Tetra Tech for the USEPA dated March 2015; using the LCFPD pre-settlement vegetation database and the Illinois Natural History Survey's Historic Vegetation database. Based on this analysis, pre-settlement vegetation consisted of approximately 5,364 acres of wetland with the Buffalo Creek Watershed. The pre-settlement communities are shown in Figure 3-17 and Table 3-10. Following European settlement, most of this land was converted to agricultural practices, followed by residential and commercial land uses.

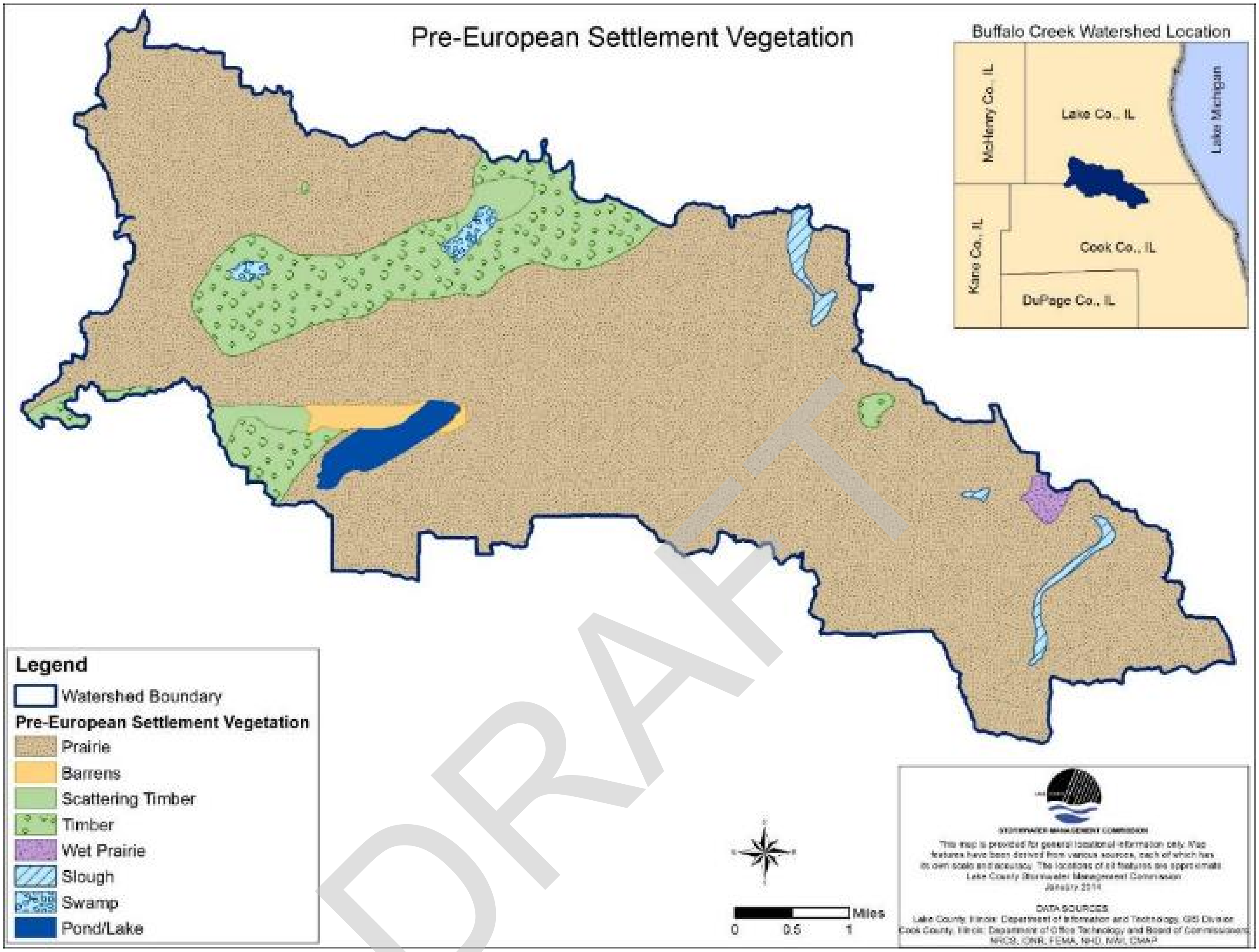


Figure 3-17: Pre-European Settlement Vegetation in the Buffalo Creek Watershed.

Table 3-10: Pre-European Settlement Vegetation in the Buffalo Creek Watershed.

Vegetation Type	Acres	% of Watershed
Prairie	14,500	83%
Barrens	133	1%
Scattering Timber	215	1%
Timber	1999	11%
Wet Prairie	67	<1%
Slough	171	1%
Swamp	84	<1%
Pond/Lake	223	1%

3.6.2 Existing Land Use/Land Cover

Existing ***land use*** of the Buffalo Creek Watershed was determined using a 2005 CMAP land use/cover layer. To ensure land use and ***land cover*** represented the most recent watershed conditions, this layer was updated by interpreting 2012 aerial imagery. If any discrepancies were observed between the imagery and the land use/cover layer, such as where development has recently occurred or where errors were noted in land use/cover categories or boundaries, adjustments were made. In addition, land use categories were simplified by grouping and re-naming similar land use codes and by extracting land cover designations from land use (i.e., cropland in a forest preserve was separated into row crops and open space conservation). Table 3-11 includes land use/cover categories, including acreage and overall percentage, and Figure 3-18 illustrates land use in map format.

The residential land use class accounts for the greatest area of the watershed with 9,394 Acres (54%). Total open space, including all open land (agricultural, private/public open space, wetlands, and water) comprises 3,026 acres or 17% of the watershed. Total developed land, including residential, commercial/retail/mixed use, government/institutional, industrial, office and research parks, transportation, and utilities accounts for 14,359 acres or 83% of the watershed.

Slough: *a swamp or shallow lake system, usually a backwater to a larger body of water.*

Barrens: *An area with vegetation that is scattered with stunted woody growth and an exposed infertile substrate that supports species adapted to fire and drought and occurs in areas climatically suitable for forest growth of large trees.*

Land Use: *The type of human activity that takes place on a particular area of land.*

Land Cover: *The physical material that covers the surface of the Earth. Such categories include forest, urban, water,*

The developed land uses in the watershed contain varying degrees of impervious cover. Impervious cover estimates were obtained from the United States Department of Agriculture's Urban Hydrology for Small Watersheds TR-55 (Revised Edition). Approximately 93% of the Buffalo Creek Watershed has some degree of impervious cover. Land use data indicates that the majority (75%) of the developed land use in the watershed is between 0-19% impervious cover. Less than 1% of the land use in the watershed is between 20-49% impervious cover. Approximately 23% of the developed land use in the watershed is between 50-79% impervious cover. Another 2% of the developed land use in the watershed is between 80-100% impervious cover.

Table 3-11: Current Land Use in the Buffalo Creek Watershed by Category.

Land Use Class	Total Area (acres)	% of Watershed
Residential - Single Family	9,394	54.00%
Commercial/Retail	1,502	8.60%
Residential - Multi-Family	1,102	6.30%
Open Space - Conservation	1,085	6.20%
Vacant	783	4.50%
Industrial	753	4.30%
Open Space – Park	662	3.80%
Gov't/Institutional	512	2.90%
Open Space - Golf Course	329	1.90%
Wetland	285	1.60%
Open Water	263	1.50%
Transportation	214	1.20%
Agriculture – Row Crop	209	1.20%
Agriculture - Greenhouse/Nursery	149	0.90%

Utilities	100	0.60%
Agriculture - Equestrian	44	0.30%
Cemetery	8	0.00%
Total	17,393	100.0%

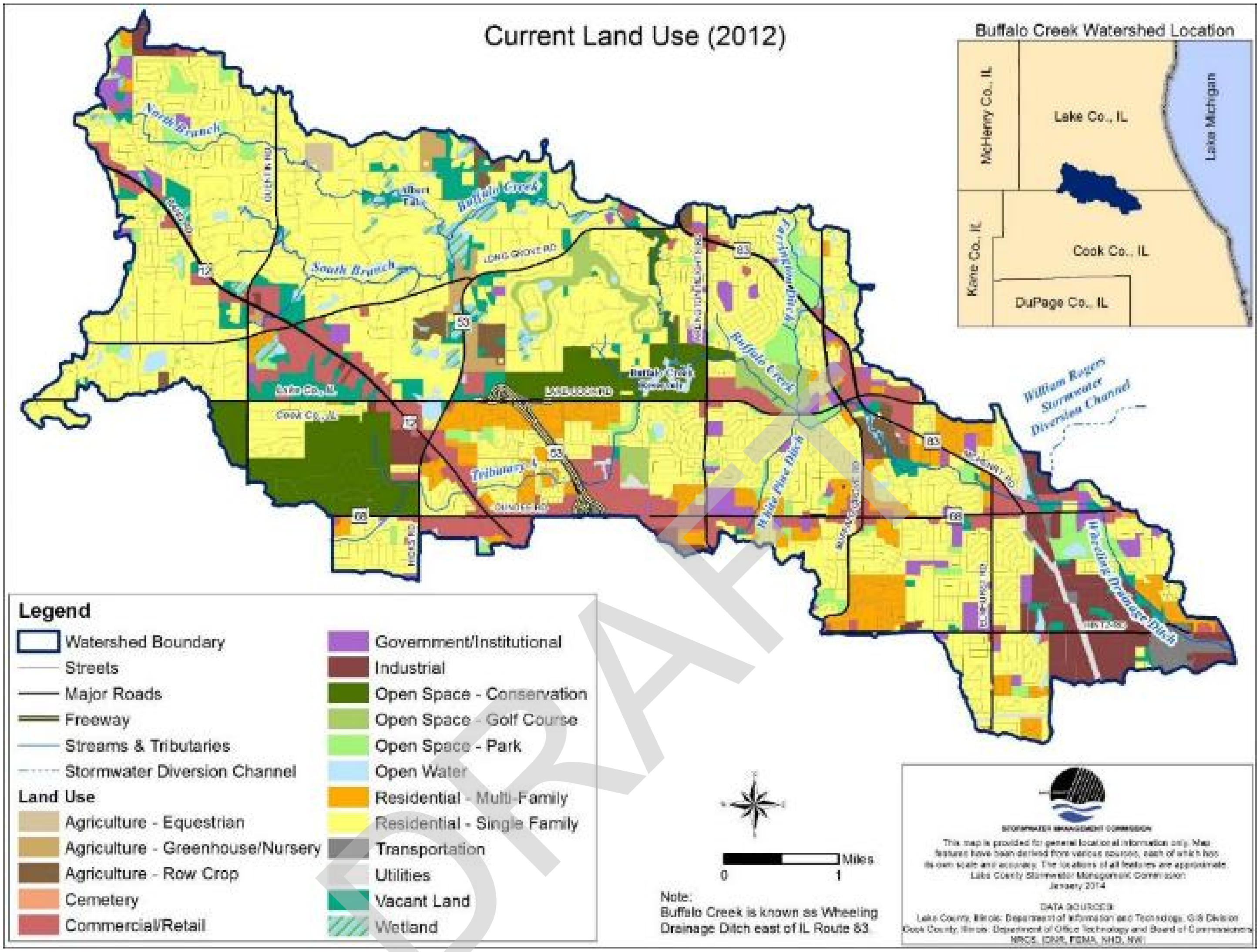


Figure 3-18: Current Land Use in the Buffalo Creek Watershed.

Noteworthy: How We Use Land Effects Water Quality

Studies have shown that land use has a direct effect on water quality. The greater amount of impervious area, the greater the pollution load it generates. Pollutants from a variety of diverse and diffuse sources collect on impervious surfaces and are flushed into rivers and streams when it rains. Lawns, driveways, rooftops, parking lots and streets are source areas for these pollutants, while the causes include vehicles, road surface applications, direct atmospheric deposition, fertilizer/pesticides/herbicides, litter, pet waste, vegetative decay, and soil erosion. Urban runoff also carries pollutants such as oil and grease, metals, and pathogens like fecal coliform bacteria. Runoff from impervious surfaces can be 10 to 12 degrees warmer than run-off from land in a natural state, which combined with reduced summer flows results in higher in-stream water temperatures.

3.6.3 Future Land Use Projections

> ***Pervious:*** *Allowing water to pass through.*

Future land use projections were based on a review of municipal future land use maps. Figure 3-19 shows future land use predicted on build-out conditions in the watershed. Approximately 3.5% of the watershed is expected to change land use; 3.4% of the watershed that is currently considered ***pervious*** will be converted to imperious cover. This is primarily a result of the increase in commercial and industrial properties and single family residential land use (see Table 3-12), which is supported by the expected increase in household and population (see Table 3-9). Approximately 95% of the expected land use changes are expected to occur on agricultural and vacant land uses. The population density is expected to increase from 7.1 persons per acre to 8.8 persons per acre.

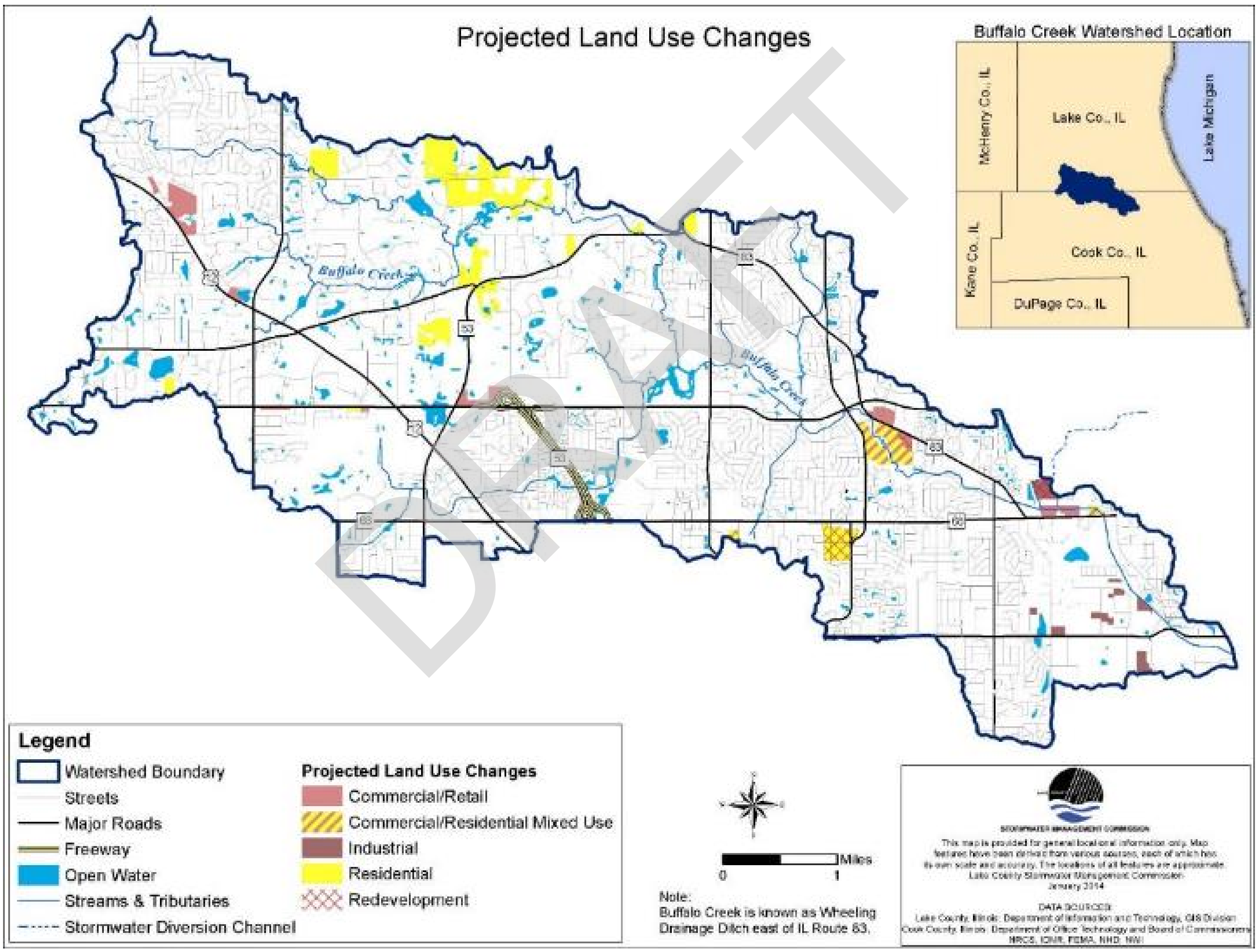


Figure 3-19: Projected Future Land Use Changes in the Buffalo Creek Watershed.

Table 3-12: Future Land Use Projections for the Buffalo Creek Watershed.

Land Use Type	2012 Acres	% of Watershed	Projected 2020 Acres	% of Watershed	% Change
Residential - Single Family	9,394	54.00%	9,743	56.00%	3.72%
Commercial/Retail	1,502	8.60%	1,624	9.30%	8.12%
Residential - Multi-Family	1,102	6.30%	1,102	6.30%	0.00%
Open Space - Conservation	1,085	6.20%	1,085	6.20%	0.00%
Vacant	783	4.50%	461	2.70%	-41.13%
Industrial	753	4.30%	799	4.60%	6.00%
Open Space - Park	662	3.80%	662	3.80%	0.00%
Gov't/Institutional	512	2.90%	512	2.90%	0.00%
Open Space - Golf Course	329	1.90%	329	1.90%	0.00%
Wetland	285	1.60%	285	1.60%	0.00%
Open Water	263	1.50%	263	1.50%	0.00%
Transportation	214	1.20%	214	1.20%	0.00%
Agriculture - Row Crop	209	1.20%	47	0.30%	-77.66%
Agriculture - Greenhouse/Nursery	149	0.90%	84	0.50%	-43.65%
Utilities	100	0.60%	100	0.60%	0.00%
Agriculture - Equestrian	44	0.30%	4	0.00%	-90.61%
Cemetery	8	0.00%	8	0.00%	0.00%
Commercial/Residential Mixed Use	-	0.00%	74	0.40%	100%
Total	17,393	100%	17,393	100%	

Noteworthy: Definitions for Land Use Types

Residential-Single Family: Includes housing where a single family resides.

Residential-Multi-Family: Includes housing where multiple separate housing units are contained in one building or complex.

Commercial/Retail: Includes shopping malls and associated parking, single building offices, office parks, restaurants, auto repair shops, grocery stores, etc.

Open Space-Conservation: Includes nature preserves, game preserves, botanical gardens and forest preserves.

Open Space-Park: Includes all parks such as athletic fields and recreational trails.

Open Space-Golf Course: Includes all public and private golf courses.

Industrial: Includes mineral extraction, manufacturing, warehousing/distribution centers and industrial parks.

Gov't/Institutional: Includes military bases and associated living quarters, medical and healthcare facilities, educational facilities, government administration and services (fire, police, post offices, etc.) and correctional facilities.

Wetland: Includes land uses that are saturated with water seasonally or permanently and contain hydric vegetation.

Open Water: Includes rivers, streams, canals (wider than 200ft), lakes, reservoirs and lagoons.

Transportation: Includes roadways, road right-of-ways, interstates, toll roads, bus facilities and air transportation centers.

Utilities: Includes waste water facilities, landfills, railroads, telephone poles and cell towers.

Agriculture -Greenhouse/Nursery: Includes nurseries, orchards and vineyards.

Agriculture -Row Crop: Includes row crops, pasture, fallow lands, dairy and other livestock enterprises.

Agriculture -Equestrian: Includes land uses for recreational horse keeping.

Cemetery: Includes cemeteries of all sizes.

3.7 Transportation

Transportation corridors in the Buffalo Creek Watershed connect residents to points within and outside of the watershed. "Car habitat," the combined area of roads, parking lots, driveways and garages is significant in the watershed. Parking lots and roads are the largest components of car habitat and can have a significant influence on stormwater runoff and water quality.

Studies have shown that streets are a major source of non-point source pollution in urban settings. A number of factors contribute to high pollutant loading from streets. Streets are typically connected to the drainage system and tend to be the collector of runoff and pollution from sidewalks, driveways, lawns, and rooftops as well as from emissions and leaks from vehicles, atmospheric deposition and winter road maintenance practices. How transportation facilities and corridors are designed, constructed and maintained can play a significant role in determining whether the influence of transportation is positive or negative as it relates to watershed health and the wellbeing of watershed residents.

The Buffalo Creek Watershed includes 364 miles of roads, 84 miles of trails and 2.2 miles of commuter rail lines that make up the existing network of transportation corridors in the watershed. Although not analyzed in detail in this section, other important components of the transportation network include the public bus transit system, parking lots, rail stations, and the public works and transportation maintenance yards that support the roads, trails and railroads in the watershed.

3.7.1 Roadways

Currently, there are approximately 343 roadway miles in the Buffalo Creek Watershed equaling 13.5 miles of road per square mile of watershed area. Roads are managed by various local and state entities with jurisdictions in Lake and Cook County. The roadway network includes local roads, township roads, county roads, and state highways. In the Buffalo Creek Watershed, roads and roadway planning are the responsibility of multiples entities including the Cook County Department of Transportation (CCDOT), Lake County Division of Transportation (LCDOT), Illinois Tollway Authority, Forest Preserve District of Cook County (FPDCC), Lake County Forest Preserve District (LCFPD), townships and municipalities. Table 3-13 provides the miles of road in the watershed per jurisdiction.

Table 3-13: Roadway Miles in the Buffalo Creek Watershed.

Roadway Jurisdiction	Miles	% of Total Watershed Miles
Buffalo Grove	64.51	18.83%
Wheeling	64.32	18.77%
Lake Zurich	34.01	9.93%
Palatine	31.15	9.09%
Long Grove	25.93	7.57%
Kildeer	23.23	6.78%
IDOT	22.67	6.62%
Arlington Heights village	19.27	5.62%
Deer Park village	14.94	4.36%
CCDOT	14.72	4.30%
LCDOT	9.1	2.66%
Illinois Tollway Authority	4.96	1.45%
Prospect Heights	4.66	1.36%
Palatine Township	4.11	1.20%
Ela Township	2.11	0.62%
Wheeling Township	1.24	0.36%
FPDCC	0.91	0.27%
LCFPD	0.82	0.24%
Total Miles	342.66	100%

Through the watershed, Rand Road, Quentin Road, and McHenry Road are the principal north-south arterials, and Lake Cook Road and Dundee Road are the principal east-west arterials. Other minor arterials in the watershed include Long Grove Road, Arlington Heights Road, Buffalo Grove Road, and West Cuba Road. Figure 3-20 shows the major roadways in the watershed and their jurisdiction. The northern terminus of IL Route 53 is located at Lake Cook Road in the central portion of the watershed and is under the jurisdiction of the Tollway.

The following roadways are under IDOT jurisdiction:

- Route 83
- Elmhurst Road
- Route 53/Hicks Road
- Long Grove Road (east of Route 53)
- Route 68/Dundee Road
- Route 12/Rand Road

The following roadways are under LCDOT jurisdiction in Lake County:

- Quentin Road
- Arlington Heights Road
- Deerfield Parkway
- Weiland Road
- Cuba Road
- Long Grove Road
- Buffalo Grove Road

The following roadways are under CDOT jurisdiction in Cook County:

- Arlington Heights Road
- Lake Cook Road
- Quentin Road
- Schoenbeck Road
- S. Buffalo Grove Road
- Hintz Road

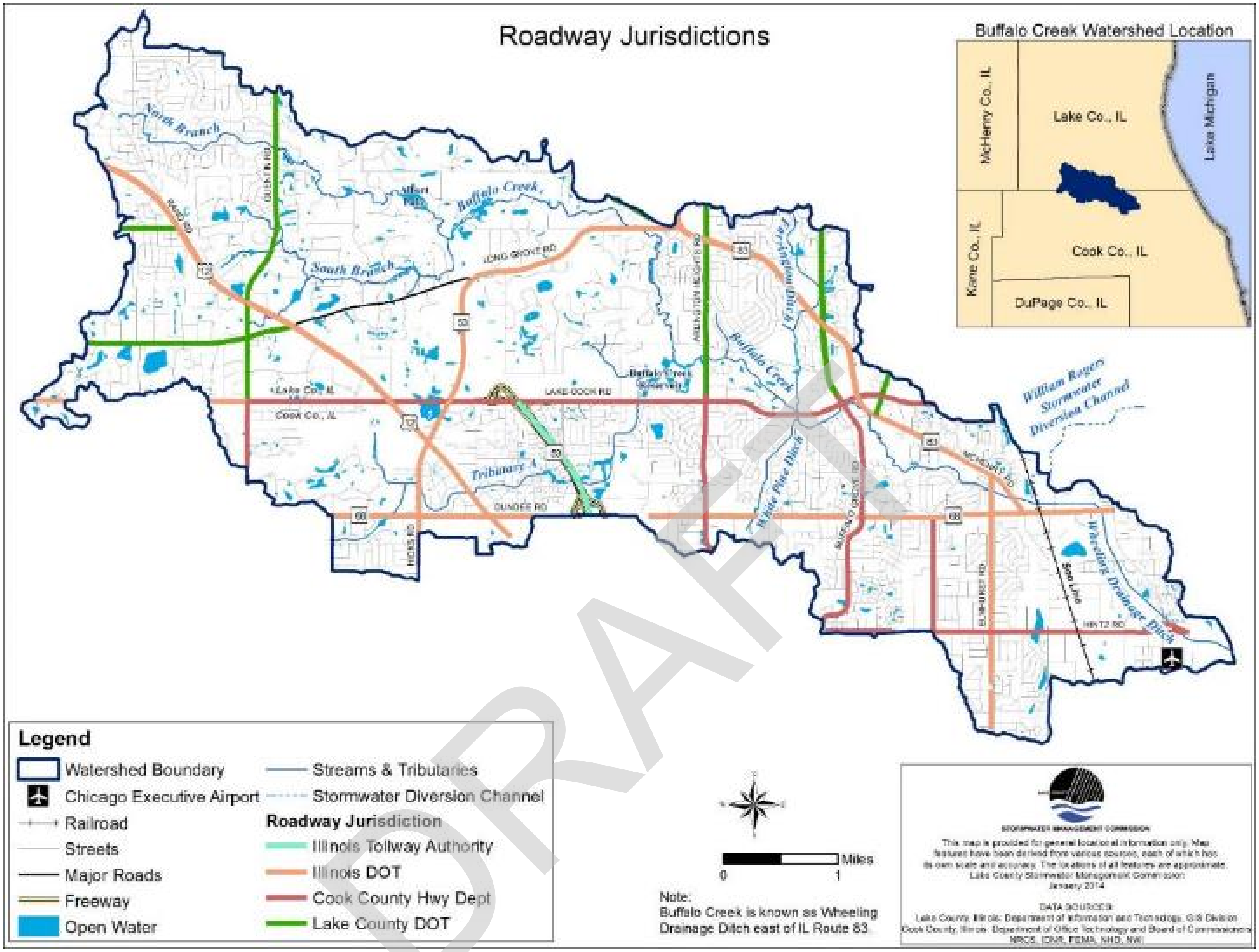


Figure 3-20: Roadway Jurisdictions in the Buffalo Creek Watershed.

3.7.2 Public Transportation

The Metra North Central Service rail line traverses the eastern portion of the Buffalo Creek Watershed (see Figure 3-20). This rail line extends from Union Station in Chicago to Antioch in northern Lake County. A Metra rail station associated with this rail line is located at 400 Town Street in the Village of Wheeling. Pace Bus Route 234 provides weekday service from the Wheeling Metra rail station to the following major destinations: Holy Family Hospital, Metra UP Northwest Line stations (Des Plaines, Cumberland, and Mt. Prospect), Randhurst Mall, Wheeling High School, Wheeling Municipal Complex, and Wheeling Tower.

Noteworthy: Streets and Non-Point Source Pollution

According to a Chesapeake Bay Commission study, residential, commercial, and industrial streets were found to be the main contributor of non-point source pollution in an urban setting. “Not only did streets produce some of the highest concentrations of phosphorus and suspended solids, bacteria and several metals, but they also generated a disproportionate amount of the total runoff volume. Consequently, streets typically contributed four to eight times the pollutant load than would have been expected if all source areas contributed equally.” (Chesapeake Bay Commission, 2003)

A number of factors contribute to high pollutant loading from streets. Streets are directly connected to the drainage system resulting in a high runoff coefficient. In addition, street curb and gutter systems tend to trap and retain fine particles that blow into them and are then flushed off by stormwater into pipes that empty to streams, rivers and lakes during a rain event or in snow melt.

3.7.3 Airports

Figure 3-21: Location of Chicago Executive Airport, courtesy of Chicago Executive Airport.

The Chicago Executive Airport is located at the downstream end of the Buffalo Creek Watershed, at the northwest corner of Palatine Road and South Milwaukee Avenue in Wheeling. The Chicago Executive Airport was founded in 1925 as Gauthier’s Flying Field. In 1928, the field was renamed Palwaukee, after the two highways that formed its southern and eastern borders (Palatine Road and Milwaukee Avenue). The airport was purchased in 1953 by George Priester, who over the next 33 years expanded and developed the facility until 1986, when it was purchased by the neighboring Villages of Wheeling and Prospect Heights. Renamed Chicago Executive Airport in 2006 to more accurately reflect its regional importance, the facility now covers 113 acres within the Buffalo Creek Watershed. The Chicago Executive Airport is a key building block and powerful economic engine for both communities, as well as the surrounding area. Today, the Chicago Executive Airport serves the general and business aviation sector, and is the third busiest airport in Chicagoland, after O'Hare International and Midway. Approximately 300 aircraft are based on the field and approximately 200,000 take-offs and landings occur annually.

Chicago Executive Airport. Photo courtesy of CMT.

The primary water quality concern regarding airports is deicing runoff. Deicing runoff into surface waters has been known to increase biological oxygen demand, alkalinity, and pH. The Chicago Executive Airport currently uses urea (a dry product) for deicing and E36 Liquid Runway Deicer (potassium acetate) for anti-icing before a storm. Drainage from the runways ends up in retention areas located on the airport property.

The Chicago Executive Airport is currently undergoing a Master Plan per the guidelines of the Federal Aviation Administration. These guidelines require the airport to consider itself as part of its surrounding and the communities it serves, as well as to examine how well the airport functions as part of the national aviation system. Other aspects such as safety, operations and financial viability are also examined as part of the Master Plan.

3.7.4 Trails

There are currently approximately 107 miles of walking paths and bike trails in the Buffalo Creek Watershed (see Figure 3-22). Trails are in various forms ranging from mowed footpaths to concrete or asphalt, and are designed for single or multiple purpose users. Several jurisdictions develop and manage trails in the watershed including the Forest Preserve Districts, Park Districts, Municipalities, Townships, HOAs, CDOT, and LCDOT. The Villages of Wheeling (42%) and Buffalo Grove (28%) account for the majority of existing trails in the watershed, with the majority of trails located in the southeast portion of the watershed. Several villages support trail systems along and across roadways within their jurisdiction, which contribute to transportation networks. Park Districts also provide and maintain a trail network to connect people to parks and other community centers. The Forest Preserves provide many miles of trails within and connecting forest preserves. HOAs provide neighborhood trails connecting to community trail systems, within the subdivision, and to neighborhood parks. Lastly, there are short segments of connector trails constructed and maintained by the LCDOT and townships that are part of a large trunk system for bicyclists.

The majority of the existing and planned trail system is located in the eastern portion of the watershed. Proposed trails in the western portion of the watershed include connecting Quentin Road, Lake Cook Road, Rand Road and Long Grove Road to the Deer Grove Forest Preserve and Deer Park Mall. Table 3-14 presents the existing and proposed trail miles by jurisdiction.

The Buffalo Creek Forest Preserve contains approximately 8 miles of bicycling, cross-country skiing, and hiking trails. The hiking and bicycle trails provide pedestrian access at the corner of Checker Road and Arlington Heights Road, on Checker Road West of Schaeffer Road and at the corner of Lake Cook and Arlington Heights Roads. A paved parking lot is located off Checker Road. The LCFPD is planning a new looped trail system as part of a proposed reservoir expansion project. Deer Grove Forest Preserve contains approximately 6.25 miles of trails within the Buffalo Creek Watershed. Additional trails are located within the preserve, but outside of the Buffalo Creek Watershed. A parking lot is accessible from Northwest Highway.

Table 3-14: Existing and Proposed Trail Mileage within the Buffalo Creek Watershed.

Jurisdiction	Existing Trails (miles)	% of Total Existing Trails	Planned Trails (miles)	Total Trail Miles	% of Total Trails
Wheeling	45.21	42.14%	7.73	52.94	36.89%
Buffalo Grove	30.43	28.36%	11.28	41.71	29.07%
Deer Park	9.86	9.19%	2.46	12.32	8.59%
LCFPD	7.26	6.77%	0.86	8.12	5.66%
FPDCC	6.25	5.83%	1.18	7.42	5.17%
Arlington Heights	4.31	4.02%	2.00	6.31	4.40%
Kildeer	1.04	0.97%	2.36	3.4	2.37%
Lake Zurich	1.02	0.95%	1.53	2.55	1.78%
Long Grove	0.88	0.82%	0.63	1.51	1.05%
Prospect Heights	0.59	0.55%	1.22	1.81	1.26%
Palatine	0.13	0.12%	3.82	3.95	2.75%
Ela Township	0.12	0.11%	0.91	1.03	0.72%
Wheeling Township	0.1	0.09%	0.33	0.34	0.24%
Vernon Township	0.09	0.08%	0	0.09	0.06%
Total	107.29	100%	36.31	143.5	100%

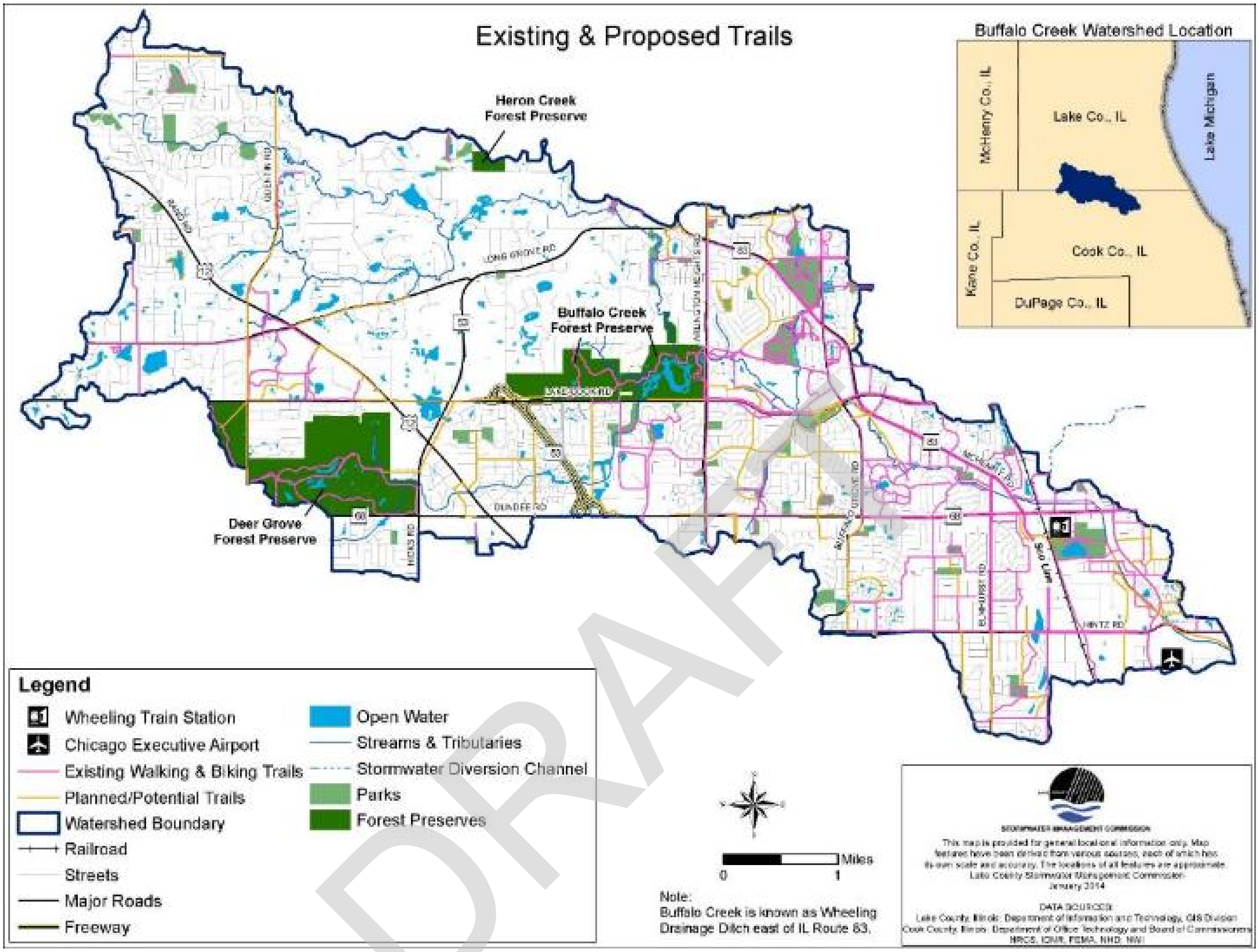


Figure 3-22: Existing and Proposed Trail Network in the Buffalo Creek Watershed.

3.7.5 Planned Transportation Improvements

Information about planned roadway improvements in the watershed was gathered through local, regional, and state transportation contacts and from available road planning reports. While the "future conditions" data gathering and research may not be exhaustive, especially as it relates to local streets that may be built to serve new commercial or residential developments in the watershed, the major county, regional, and state roadway projects that are being planned for the watershed are described in this section and shown in Figure 3-23.

3.7.5.1 LCDOT Planned Projects

The following projects are identified on the 2013-2018 Highway Improvement Program:

Buffalo Grove Road Widening from Deerfield Parkway to IL Route 22– LCDOT is performing a Preliminary Engineering and Environmental Study (Phase I Study) for Buffalo Grove Road from Deerfield Parkway to IL Route 22 in Lake County (see Figure 3-24). The purpose of the Phase I Study is to evaluate the long term improvement needs for Buffalo Grove Road in compliance with criteria for environmental studies. A concrete bike path (8' wide) runs along the east side of Buffalo Grove Road for most of its length. Just north of Aptakisic Road the path moves into the subdivision to the west before working its way back to Buffalo Grove Road. The Village of Buffalo Grove is interested in completing the bike path north along Buffalo Grove Road where there is currently a gap. The first public meeting was held from 5:00 pm to 7:00 pm on November 8, 2011, at Twin Groves Middle School.

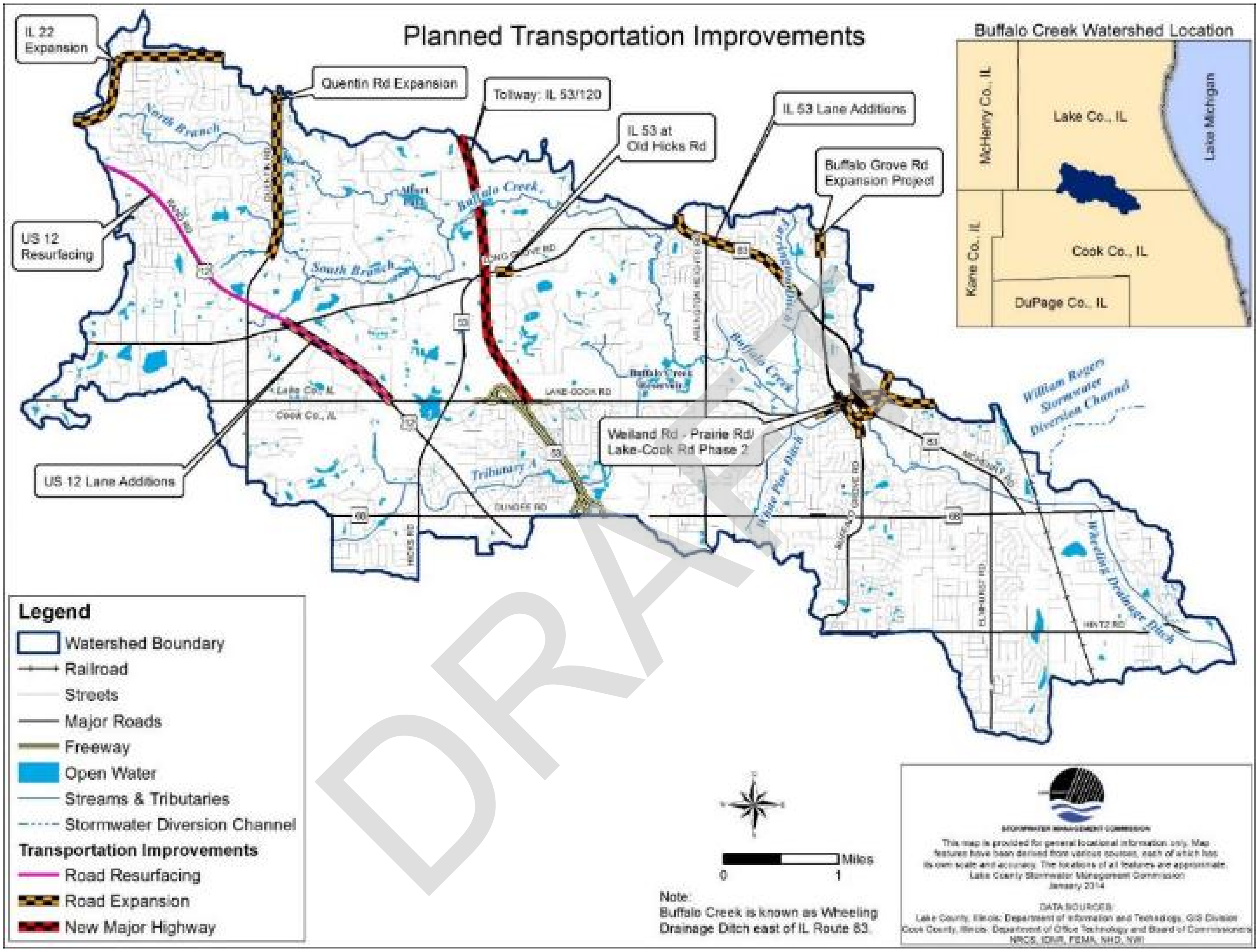


Figure 3-23: Planned Transportation Improvements in the Buffalo Creek Watershed.

Weiland Road & Lake Cook Road Improvements – This project consists of the widening and reconstruction of over three miles of Weiland Road and over one mile of Lake Cook Road in the Villages of Buffalo Grove and Wheeling (see **Figure 3-25**). The improvement will include two through lanes in each direction on Weiland Road

Weiland Road project location photo, courtesy of Civiltech Engineering, Inc.

and three through lanes in each direction on Lake Cook Road, separated by a center median to allow for left turn channelization at intersections. This project also includes the construction of a new roadway on a new alignment that will link up Weiland Road directly with Prairie Road. Short Aptakisic Road will also be realigned between Buffalo Grove Road and IL Route 83 to improve safety and operation and provide a route that can better accommodate traffic movements between Buffalo Grove Road and both Weiland Road and Lake Cook Road. In addition, pedestrian and bicycle accommodations will be provided.

Figure 3-24: Buffalo Grove Road from Deerfield Parkway to IL Route 22 Widening Project Location Map.

The proposed improvements include the widening in-kind of the single span rolled beam bridge that carries Buffalo Grove Road over Buffalo Creek, and the replacement of the triple cell box culvert that carries short Aptakisic Road over Buffalo Creek with a three-span slab bridge. The use of a three-span slab bridge is preferred over a box culvert, where the natural substrate is replaced with the structure. Furthermore, the box culvert tends to trap large deposits of sediments, impeding the flow of water. The proposed improvements include numerous drainage features within the project area including new storm sewers and new detention basins that will collect a majority of the roadway runoff before it enters Buffalo Creek.

3.7.5.2 IDOT Planned Projects

Projects funded in 2015-2020 IDOT Multi-Modal Multi-Year Program (MYP) include the following:

- Resurfacing of US 12 **from Ela Road to Lake-Cook Road**; includes milled rumble strip. Construction is targeted for the early portion of 2016-2020 MYP.
- **IL 53 at Old Hicks Road** – Add left turn lane on IL Route 53 at Old Hicks Road.

Figure 3-25: Weiland Road – Prairie Road / Lake Cook Road Phase 2 Improvements.

Unfunded identified needs on the IDOT system include:

- Addition of lanes on US Route 12 from 0.1 miles north of Long Grove Road to Lake-Cook Road.
- Addition of lanes on IL Route 83 from IL Route 22 to 0.2 miles south of Lucinda Drive.

3.7.5.3 Tollway Planned Projects

IL Route 53 / 120: New road construction to extend approximately 12.5 miles of Route 53 through central Lake County to connect with an approximate 12 miles of an improved Route 120 is being studied as shown in Figure 3-26. This project would result in approximately 2 miles of new roadway in the Buffalo Creek Watershed. While an Illinois Route 53 northern extension has been considered since the 1960s, it was not widely accepted. The Tollway established the Illinois Route 53 / 120 Blue Ribbon Advisory Council (BRAC) in 2011 to develop regional consensus on whether the Tollway should move forward with the project. The BRAC outlined its findings in a June 7, 2012 Resolution and Summary Report, concluding that there is consensus for the Tollway to move forward with the project. The BRAC report provided the scope, configuration, and design elements of the new roadway and identified potential methods for financing the project.

The BRAC defined a set of guiding principles to ensure that outcomes are clearly defined and the project fulfills its goals. The most important of these principles is to use innovative and environmentally beneficial design solutions to strike a balance between improving mobility and access while minimizing negative environmental and long-term developmental impacts. The Illinois Route 53 / 120 Project is proposed to be a modern boulevard with a small footprint to protect the natural environment and preserve the character of Lake County. The current proposal includes the following improvements:

- Extension of Illinois Route 53 – four lanes at 45 mph from Lake Cook Road to just south of Illinois Route 120.
- Upgrade of existing Illinois Route 120 (west end) – four lanes from U.S. Route 12 to west terminus of Illinois Route 120 Bypass.
- Illinois Route 120 Bypass – four lanes at 45 mph from east of Wilson Road to east of U.S. Route 45.
- Upgrade of existing Illinois Route 120 (east end) – four lanes from east terminus of Illinois Route 120 Bypass to the Tri-State Tollway (I-94).

3.7.6 Potential Impacts of Roadway Expansion Projects on the Watershed

As described earlier in this section, “car habitat” makes up a significant area of impervious cover in the watershed. As impervious surfaces such as roadways and parking lots increase, more water flows off and is delivered quickly to receiving waters. The increased activity on these impervious surfaces means that more polluting material is available and likely to be flushed in stormwater runoff. Minimizing the mobilization of this material from streets and highways where pollutants tend to accumulate and collect is the goal of successful roadway runoff management. Table 3-15 includes a list of the types of constituents in highway runoff that are sources of pollution.

Figure 3-26: Illinois Route 53/120 Project Route in the Buffalo Creek Watershed.

The design of ***rights-of-way*** has a significant impact on the livability of communities as well as the health, safety and welfare of residents. Roadway improvement projects are intended to benefit watershed and county residents and the local economy by providing better transportation access. While these are necessary goals, the fact that these projects also have the potential to have significant negative impacts on water quality and aquatic resources if not designed and maintained in ways that avoid and minimize these impacts cannot be overlooked.

Transportation agencies face several challenges in addressing the volume of runoff from roadways and the pollutants typical in roadway runoff. A transportation jurisdiction frequently has limited control of the pollutants entering its ***right of way*** (including pollutants generated from atmospheric deposition, vehicle operation, litter, organic debris, and surrounding land uses). In addition, highway projects are linear in nature and, as such, are faced with practical limitations in terms of locating and maintaining stormwater treatment facilities within the road right of way. As public agencies, transportation agencies must be accountable to taxpayers to provide cost-effective stormwater facilities, but they frequently lack funding mechanisms (such as stormwater utility fees). In addition, regional and state transportation agencies also lack the land use controls (zoning and land use ordinances) that are available to municipalities and counties.

> ***Rights-of-way:*** *Land granted for transportation purposes.*

Table 3-15: Highway Runoff Constituents and Their Primary Sources.

Constituents	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material, lubricating oil and grease, bearing wear)
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guard rails etc.), moving engine parts
Copper	Metal plating, bearing and bushing wear, moving engine parts, brake lining wear, fungicides and insecticides
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anti-cake compound (ferric ferrocyanide, sodium ferrocyanide, yellow prussiate of soda) used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate
PCB	Spraying of highway rights-of-way, background atmospheric deposition, PCB catalyst in synthetic tires

Source: US DOT, FHWA, Report No. FHWA/RD-84/057-060, June, 1987; USEPA 1993.

3.7.7 Roadway Design and Maintenance

Even considering these challenges, transportation agencies have the authority to design and maintain roadways and public transportation facilities that deliver multiple benefits and include structural and non-structural BMPs that reduce stormwater runoff and pollutants from roadways. Because adjacent land uses influence the contribution of pollutants from roadways, the stormwater management features of the roadway need to be designed and maintained in consideration of adjacent land use. By using BMPs, transportation jurisdictions can design and maintain roads to achieve the following objectives:

- Reduce the volume of polluted runoff reaching receiving waters.
- Incorporate stream crossings that protect aquatic habitat.
- Address the impacts of roadway proximity to sensitive lakes/wetlands.
- Reduce chloride pollution resulting from road salt and winter maintenance practices.
- Connect the green infrastructure network and include wildlife crossings.
- Connect people and communities – including low/moderate income areas to the transportation network (bus lines, trails).

Watershed-healthy and sustainable transportation BMPs that may be implemented to move toward sustainability in the watershed include:

- Incorporate BMPs into new and expanded roadway designs
    - Practices that reduce runoff volume from roads and parking lots (reduce pavement extent, use porous pavement where appropriate, infiltrate runoff where appropriate).

  - Practices that capture and treat runoff.
  - Route roadways to avoid waters and wetlands where possible.
  - Include environmentally friendly stream crossings that protect aquatic habitat.
  - Provide for safe, accessible and connected non-motorized transportation (including underserved and low to moderate income areas with alternative transportation options).
  - Consider wildlife crossings.
- Use I-LAST Scoring System for all new roadway expansion and extension projects (see Noteworthy).
- Construction BMPs
  - Soil erosion and sediment control (install BMPs first, phase ground disturbance if possible, button up construction site daily, minimize length of time ground is bare and disturbed).
  - Provide adequate construction oversight.
- Post construction BMPs
  - Monitoring and maintaining BMPs post-construction.
  - Street sweeping and inlet cleaning.
  - Winter maintenance (develop a winter maintenance policy and use alternative products and practices such as liquids, anti-icing, calibrating trucks and equipment).

Noteworthy: The Illinois – Livable and Sustainable Transportation Rating System and Guide (I-LAST)

The Purpose of the I-LAST guide is to:

- Provide a comprehensive list of practices that have the potential to bring sustainable results to highway projects.
- Establish a simple and efficient method of evaluating transportation projects with respect to livability, sustainability, and effect on the natural environment.
- Record and recognize the use of sustainable practices in the transportation industry.

I-LAST goals to provide sustainable features in the design and construction of highway projects are:

- Minimize impacts to environmental resources
- Minimize consumption of material resources
- Minimize energy consumption
- Preserve or enhance the historic, scenic and aesthetic context of a highway project
- Integrate highway projects into the community in a way that helps to preserve and enhance community life
- Encourage community involvement in the transportation planning process
- Encourage integration of non-motorized means of transportation into a highway project
- Find a balance between what is important:
    - Ø to the transportation function of the facility
    - Ø to the community
    - Ø to the natural environment
    - Ø and is economically sound
- Encourage the use of new and innovative approaches in achieving these goals.

I-LAST includes a point system for evaluating the sustainable measures included in a project. The evaluation includes environmental and water quality metrics in addition to others and it consists of two steps:

1. At the beginning of the project, the project team can determine which elements are applicable to the project. Applicable items can be noted and considered in the development of the project.
2. At the end of the project, the team can determine which of the applicable items were included in the project plans. This evaluation can then be included in the project's file.

Note: I-LAST is purely advisory in nature, while it is intended to ascertain and document sustainable practices proposed for inclusion on state highway projects, use of I-LAST is purely voluntary on the part of the jurisdictional agency for which a project is being developed and completed.

From: I-LAST™ Illinois - Livable and Sustainable Transportation Rating System and Guide, 2009

3.8 Parks and Recreation

3.8.1 Forest Preserves

Three forest preserve areas totaling 1,083 acres (651 acres in Cook County, 432 acres in Lake County) are located in the Buffalo Creek Watershed and are described below. There are approximately 8.7 acres of forest preserves per 1,000 residents in the watershed.

3.8.1.1 Heron Creek Forest Preserve

Heron Creek Forest Preserve. Photo courtesy of the LCFPD website (www.lcfpd.org/heron-creek).

Heron Creek Forest Preserve is a 242-acre preserve (24 acres in the Buffalo Creek Watershed) located on the southwest corner of Route 22 and Old McHenry Road in Long Grove. The preserve features a rolling landscape of scenic woodlands and open fields. The preserve offers exceptional wildlife habitat and plant communities, including a sedge meadow. The preserve includes 2.3 miles of gravel trails for hiking, biking, and cross-country skiing (all located outside of the Buffalo Creek Watershed). More than 116 species of birds appear here, including a resident population of waterfowl and herons. Heron Creek Forest Preserve is owned by the LCFPD.

3.8.1.2 Buffalo Creek Forest Preserve

The Buffalo Creek Forest Preserve is a 408-acre preserve located on the southern border of Lake County in an unincorporated region of the county. Prior to European settlement, this land supported a tall-grass prairie interspersed with a few small wetlands. Restoration of that prairie has been underway since the 1980s. Though the land has been drastically altered, first by farming and later during reservoir construction, a surprising diversity of grassland birds use the preserve, including bobolinks and eastern meadowlarks. Much of this preserve is managed for flood control, as displayed by a dam on Buffalo Creek and the reservoir that results. Careful and creative design of the reservoir has created a natural-looking wetland. There are also expansion and improvement plans being developed by the MWRD and LCFPD. These expansion and improvement plans would improve the floodwater storage of the reservoir, habitat, and public access throughout the reservoir. The recently proposed expansion of Buffalo Creek Reservoir would increase the wetland habitat by 0.7 acres and the emergent area by 4.5 acres. Increases in wetland and emergent vegetation from this proposed expansion would likely increase nutrient uptake, while also reducing shoreline erosion. Buffalo Creek Forest Preserve is owned by the LCFPD.

Photo of the spillway at the Buffalo Creek Reservoir. Photo courtesy of M. Knysz.

As previously stated in the Trails Section above, the Buffalo Creek Forest Preserve contains eight miles of bicycling, cross-country skiing, and hiking trails. The MWRD, in cooperation with the LCFPD, is developing engineering design plans to expand MWRD's existing Buffalo Creek Reservoir and improve public access at the preserve. A new looped trail system will surround the new reservoir, providing a variety of scenic views and recreational opportunities. The reservoir will also offer visitors a second location within the Preserve for shoreline fishing. Planned natural resource restoration efforts include transforming an existing agricultural field into high-quality wetland and prairie, installing a man-made rookery for nesting herons and egrets, planting hundreds of native oaks along the trails and in groves in the prairie, and reseeding the entire Preserve with native prairie grasses and flowers.

Public access improvements include redesigning existing recreational trails and reconstructing them on higher ground to protect from washouts during flood events. Other plan elements include creating new trail loops and foot bridges, constructing a new trail link to the Long Grove Park on Old Hicks Road, building two family picnic shelters, expanding the current parking area on Checker Road and adding a second entrance, parking area and restroom facility off of Schaeffer Road.

3.8.1.3 Deer Grove Forest Preserve

Deer Grove East Forest Preserve. Photo courtesy of Friends of Deer Grove East.

Deer Grove Forest Preserve (which consists of Deer Grove East and Deer Grove West) sits along the border of the Buffalo Creek and Salt Creek watersheds in Cook County. Deer Grove Forest Preserve is owned by the Cook County Forest Preserve District. Most of Deer Grove Forest Preserve once drained into Buffalo Creek; however, at some point the mainstem of Buffalo Creek running through Deer Grove West was re-routed into Salt Creek, thus at present most of Deer Grove West drains southward into Salt Creek. Most of Deer Grove East and a small portion of Deer Grove West still drain into Buffalo Creek.

In 1916, soon after the Cook County Forest Preserve District was established as the Nation's first forest preserve district, it purchased the first 500 acres of what would become Deer Grove West, making Deer Grove the first forest preserve site in the country. Deer Grove West currently consists of approximately 1,200 acres (93 acres in the Buffalo Creek Watershed) and represents a significant natural area right in our midst. Deer Grove West was dedicated as an Illinois Nature Preserve in 2010.

Deer Grove West contains several significant natural communities, including oak woodland, a forested ravine, numerous wetlands of varying sizes, and savanna and prairie remnants. Deer Grove West is identified in the INAI. Deer Grove East is approximately 624 acres (558 acres in the Buffalo Creek Watershed) and is located just east of Deer Grove West Forest Preserve. While Deer Grove West is primarily wooded, Deer Grove East is more open, with recently restored wetlands and prairie, including 23 wetlands restored by disabling drain tiles that drained former farm fields at the site. Approximately 120 acres of buffer areas consisting of woodland, savanna, and prairie areas are also being restored and monitored as habitat for native plants, birds, insects, reptiles and amphibians.

The Deer Grove Preserve is also home to Camp Reinberg, which offers a wide variety of recreation opportunities. Improvements to Camp Reinberg are outlined in the district's 2013 Camping Master Plan. The district's ultimate plan at Camp Reinberg is to renovate the existing dining hall and security building, provide tent sites, small cabins, a limited number of RV sites and toilet and shower facilities. The maximum capacity will be 217 persons or campers. The District has requested approval to connect to the Village of Palatine's sanitary sewer to remedy the existing failing septic system. Camp Reinberg holds one of the two National Pollutant Discharge Elimination System Permits in the watershed from the Illinois EPA for point discharges into Buffalo Creek. Figure 3-27 shows the Master Plan for Camp Reinberg (taken from the Cook County Forest Preserve District Master Plan).

Workday at Deer Grove. Photo courtesy of Friends of Deer Grove East.

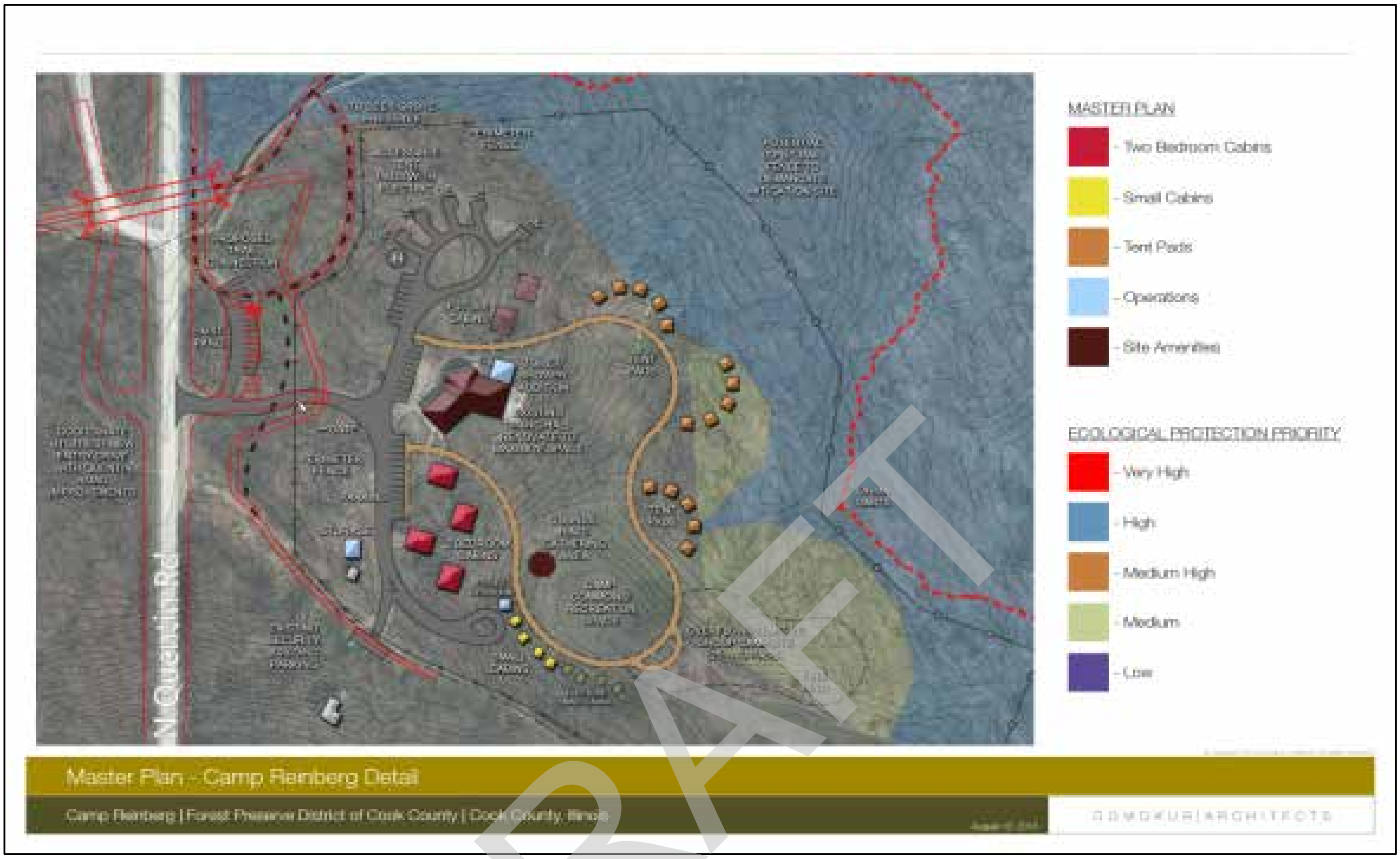


Figure 3-27: Camp Reinberg Master Plan.

The Friends of Deer Grove East is a stewardship group that was formed in 2011 to support and extend restoration work in the mitigated wetlands and buffer areas. The BCCWP co-sponsors workdays and events, and members also lead volunteer work at the Preserve. Overall, more than 400 volunteers have participated in the following activities:

1. Habitat Restoration – including brush cutting and seed gathering at monthly and Earth Day workdays.

2. Citizen Science – monitoring animals and plants, including scouting for noxious invasive plants and ***RiverWatch*** program macro-invertebrate monitoring within the Preserve.

3. Community Outreach – sponsoring educational, recreational and volunteer events.

4. Communications – photography, website, Facebook, writing, speaking to groups.

RiverWatch: *a partnership among Illinois citizens to monitor, restore and protect the state's rivers and streams. RiverWatch volunteers conduct stream habitat assessments and assist in the sampling and identification of aquatic macro-invertebrates. Data collected by Citizen Scientists is posted to an electronic bulletin board and used by the scientific community to gauge long-term trends in the environment.*

RiverWatch sampling event in Buffalo Creek. Photo courtesy of the Buffalo Creek Clean Water Partnership.

3.8.2 Parks

Sixty-six parks totaling approximately 667 acres were identified within the Buffalo Creek Watershed. The breakdown of parks per municipality is presented in Table 3-16 and graphically displayed in Figure 3-28.

Table 3-16: Distribution of Parks with the Buffalo Creek Watershed.

Park Location	Size (Acres)	% of the Watershed
Arlington Heights	57.0	0.33%
Buffalo Grove	272.5	1.57%
Deer Park	54.2	0.31%
Lake Zurich	111.6	0.64%
Long Grove	23.7	0.14%
Palatine	29.5	0.17%
Prospect Heights	13.1	0.08%
Wheeling Township	0.2	0.00%
Wheeling	106.7	0.61%
Total	666.6 acres	3.84%

Busch Grove Community Park. Photo courtesy of M. Knysz.

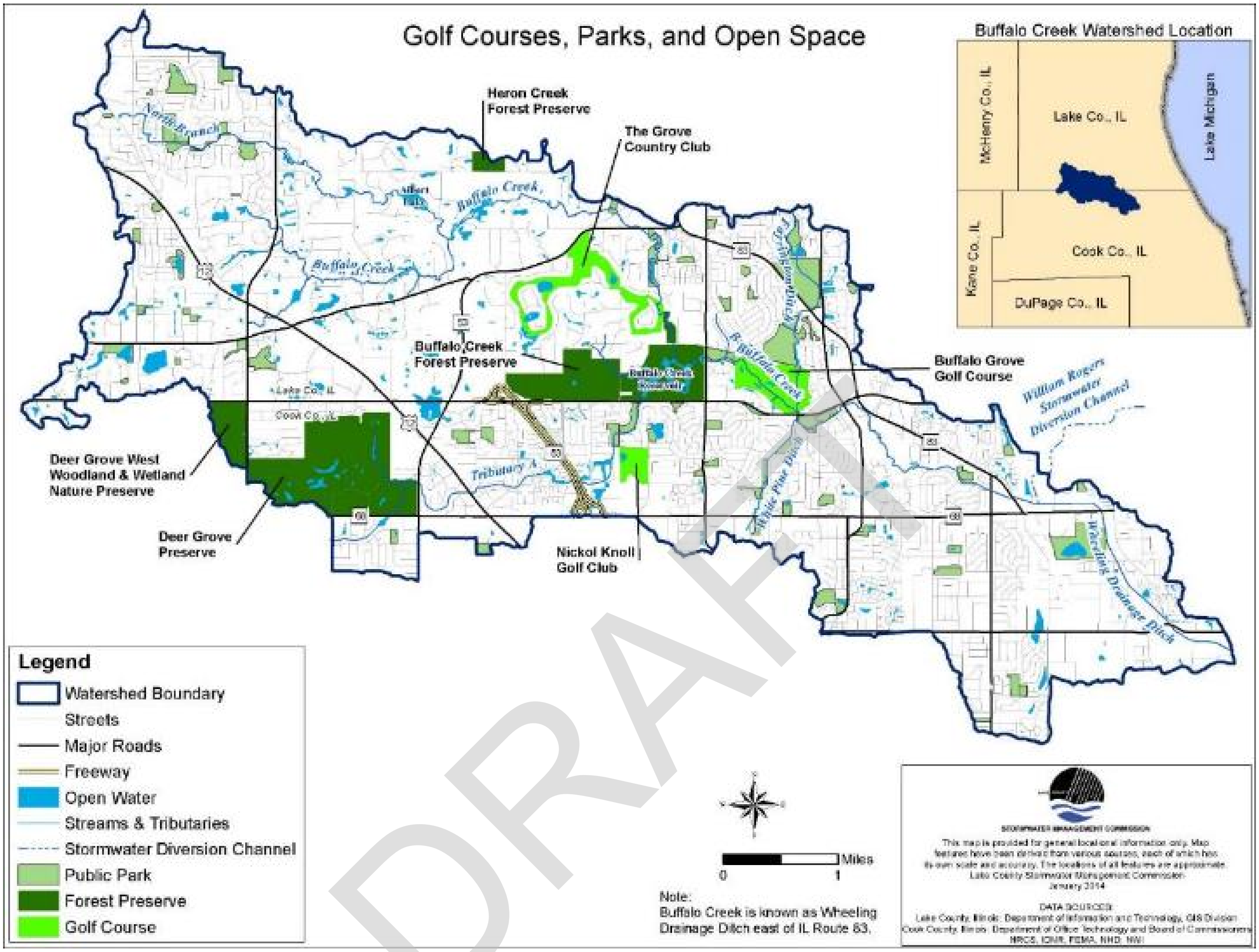


Figure 3-28: Location of Golf Courses, Parks, and Open Space in the Buffalo Creek Watershed.

One park, the Buffalo Creek Nature Center, is situated in a key location with the watershed, immediately downstream of the Buffalo Creek Reservoir. The Buffalo Creek Nature Preserve is a 15-acre park owned by the Village of Buffalo Grove, located southeast of the intersection of Arlington Heights Road and Checker Drive (see Figure 3-28). The Buffalo Creek Nature Preserve contains important natural areas including floodplain, prairie, wetlands, and the Buffalo Creek mainstem. A system of paved paths are located throughout the park, including an underpass under Arlington Heights Road which connects the park to the Buffalo Creek reservoir. The south end of the park is adjacent to the Buffalo Grove Golf Course.

Educational sign at the Buffalo Creek Nature Preserve. Photo courtesy of M. Knysz.

3.8.3 Golf Courses

Three golf courses totaling approximately 329 acres are located within the Buffalo Creek Watershed (see Figure 3-28) and are described below.

The Grove Country Club (148.8 acres) is a privately owned facility located at 3217 RFD in Long Grove, just west of Illinois Route 83. The Grove Country Club features a 7,000-yard, par 72 layout in addition to four other sets of tees. The country club also includes a clubhouse, outdoor swimming pool, and tennis courts. Approximately 900 feet of the Buffalo Creek mainstem is located on the golf course property.

The Buffalo Grove Golf Course (134 acres) is located north of Lake Cook Road and west of Buffalo Grove in Buffalo Grove. This golf course is owned and operated by the Village of Buffalo Grove. The 18-hole course offers three sets of tees and the property also includes four ponds, clubhouse, restaurant, driving range, and maintenance facility. The golf course is located within the 100-year floodplain of Buffalo Creek and also contains approximately 3,800 feet of the Buffalo Creek mainstem and approximately 2,000 feet of Farrington Ditch.

Buffalo Grove Golf Course. Photo courtesy of the Village of Buffalo Grove.

The Nickol Knoll Golf Club (46 acres) is located on N. Kennicott Avenue in Arlington Heights, north of Dundee Road and west of Arlington Heights Road. This 56-acre golf course is owned and operated by the Arlington Height Park District. The course features 9 holes totaling 1,163 yards. The property drains to a detention basin located at the northwest corner of the golf course, ultimately draining directly to Tributary A.

Photo of geese on a golf course. Source: www.birdbgone.com.

Stormwater runoff from all three golf courses flows directly into Buffalo Creek and Tributary A. Landscaping and maintenance practices at the golf courses directly impact Buffalo Creek. While fertilizers and pesticides maximize productivity and performance of turf grass, the Buffalo Creek Watershed may be at risk from spills of concentrated chemicals used to mix fertilizers and pesticides for application. Of the many nutrients applied to golf turf, the primary contaminants of concern in fertilizers are nitrogen and phosphorus, which contribute to algal growth, weeds, and the impairment of water. Pesticides may be toxic to aquatic and terrestrial systems depending on their solubility, toxicity, and chemical breakdown rate. Other potentially hazardous materials, such as fuels and paints that are used in everyday operation and maintenance, can contaminate water quality if accidentally related. Golf course BMPs should be followed for maintenance operations to prevent contamination from accidental releases.

Another significant source of pollution from golf courses are waterfowl. Shallow ponds surrounded by mowed turf grass attract significant populations of waterfowl. Deposits of fecal matter by resident and migrating waterfowl (primarily Canada Geese) may contribute to high levels of fecal coliform in the Buffalo Creek Watershed.

Golf courses in the Buffalo Creek Watershed should employ BMPs to prevent and minimize negative effects of golf course management on surface and groundwater in the watershed. Pollution prevention is easier, less expensive, and more effective than addressing problems "downstream". Essentially, BMPs are a sustainable approach to providing environmental, economic, and social benefits to golfs and the environment. Recommended BMPs for golf courses (Cornell University, 2014) include:

- Maintain a 100 foot buffer around waterways for chemical storage and mixing. Storage areas should have a raised berm on all sides and an impervious surface for containment. Facilities should be equipped with "spill containment material".

- Grass clippings and debris removed from equipment should be disposed of properly and not allowed to be released into waterways.
- Determine accurate supplemental nutrient needs based on soil chemical and physical analysis.
- Assess nutrient application efficiency through regular equipment calibration.
- Maintain turf with high shoot density to minimize runoff and maximize infiltration.
- Manage the surface accumulation of organic matter to maintain a permeable system that minimizes runoff and maximizes subsurface retention.
- Select turf that is well adapted to site conditions. Well adapted species require reduced amounts of fertilizer and pesticides, and if selected for drought tolerance, requires less water to survive and maintain playability.
- Minimize the amount of fertilizer and chemicals used during the establishment phase as establishing turf does not provide the needed uptake to prevent runoff and leaching.
- Implement methods such as core cultivation, deep slicing and water injection to alleviate soil compaction and remove organic material, resulting in increased infiltration and reduced runoff.
- Utilize proper topdressing material to maintain permeable turf.
- Utilize a combination of preventative and reactive strategies to manage pest problems. Select management options according to site conditions instead of the calendar.
- Utilize biological controls (other living organisms) to suppress or eliminate pests.
- Establish wetland fringes around ponds to reduce populations of geese (geese prefer open water with closely mowed, visible banks to they can see predators approaching).

3.9 Natural Resources

3.9.1 Threatened and Endangered Species

Threatened and ***endangered (T&E)*** species and communities, rare habitats, and important natural areas, including natural area inventory sites, forest preserves, nature preserves, and high quality ***advanced identification (ADID)*** wetlands make up the high quality natural resources in the watershed. While no Federally endangered or threatened species have been observed in the watershed, there are several Illinois "state-listed" species present.

As of 2014 there are 138 state-listed T&E species listed for Lake County and 117 state-listed T&E species for Cook County, with 8 species located in the Buffalo Creek Watershed. Table 3-17 lists each state-listed T&E species observed within the watershed and provides additional information, such as status and source of data. State-listed T&E species are designated "endangered" if in danger of extinction as a breeding species, while a "threatened" species includes any breeding species that is likely to become an endangered species within the foreseeable future.

Endangered: *An "endangered" species is one that is in danger of extinction throughout all or a significant portion of its range.*

Threatened: *A "threatened" species is one that is likely to become endangered in the foreseeable future.*

Advanced Identification (ADID) Sites: *Aquatic sites that have been determined to provide biological value by the USACE, Chicago District and the USEPA.*

The majority of the Illinois T&E species were found near Deer Grove West Woodland and Wetland Nature Preserve, which is the only state-dedicated nature preserve in the Buffalo Creek Watershed. Ecologically significant and protected areas in the Buffalo Creek Watershed provide habitat for T&E species and contain examples of high-quality natural communities. These areas include ADID wetlands, one Illinois Natural Area Inventory (INAI) Site (Deer Grove West), three forest preserves (Deer Grove, Heron's Creek, and Buffalo Creek Reservoir), and one Illinois Nature Preserve (Deer Grove West).

Table 3-17: T&E Species Occurrences in the Buffalo Creek Watershed.

Common Name	Scientific Name	Type	Status*	Source
Black Tern	*Chlidonias niger*	Vertebrate Animal	SE	IDNR
Blanding's Turtle	*Emydoidea blandingii*	Vertebrate Animal	SE	IDNR
Bulrush	*Scirpus hattorianus*	Vascular Plant	ST	IDNR
Common Moorhen	*Gallinula chloropus*	Vertebrate Animal	SE	IDNR
Forked Aster	*Aster furcatus*	Vascular Plant	ST	IDNR
Marsh Speedwell	*Veronica scutellata*	Vascular Plant	ST	IDNR
Mountain Blue-eyed Grass	*Sisyrinchium montanum*	Vascular Plant	SE	IDNR
Yellow-headed Blackbird	*Xanthocephalus*	Vertebrate Animal	SE	IDNR

*ST= State Threatened SE=State Endangered

3.9.2 High Quality Natural Areas

One dedicated Illinois Nature Preserve and three Forest Preserves (totaling 1,083 acres) are located in the watershed and are owned and maintained by either the Lake or Cook County Forest Preserve District. The Illinois Nature Preserves are designated by the Illinois Nature Preserves Commission, but maintained by the property owner with oversight from the Illinois Nature Preserves Commission and offer the highest level of protection for rare flora and fauna and high quality natural communities. Figure 3-29 identifies the location of the high quality natural resources in the watershed.

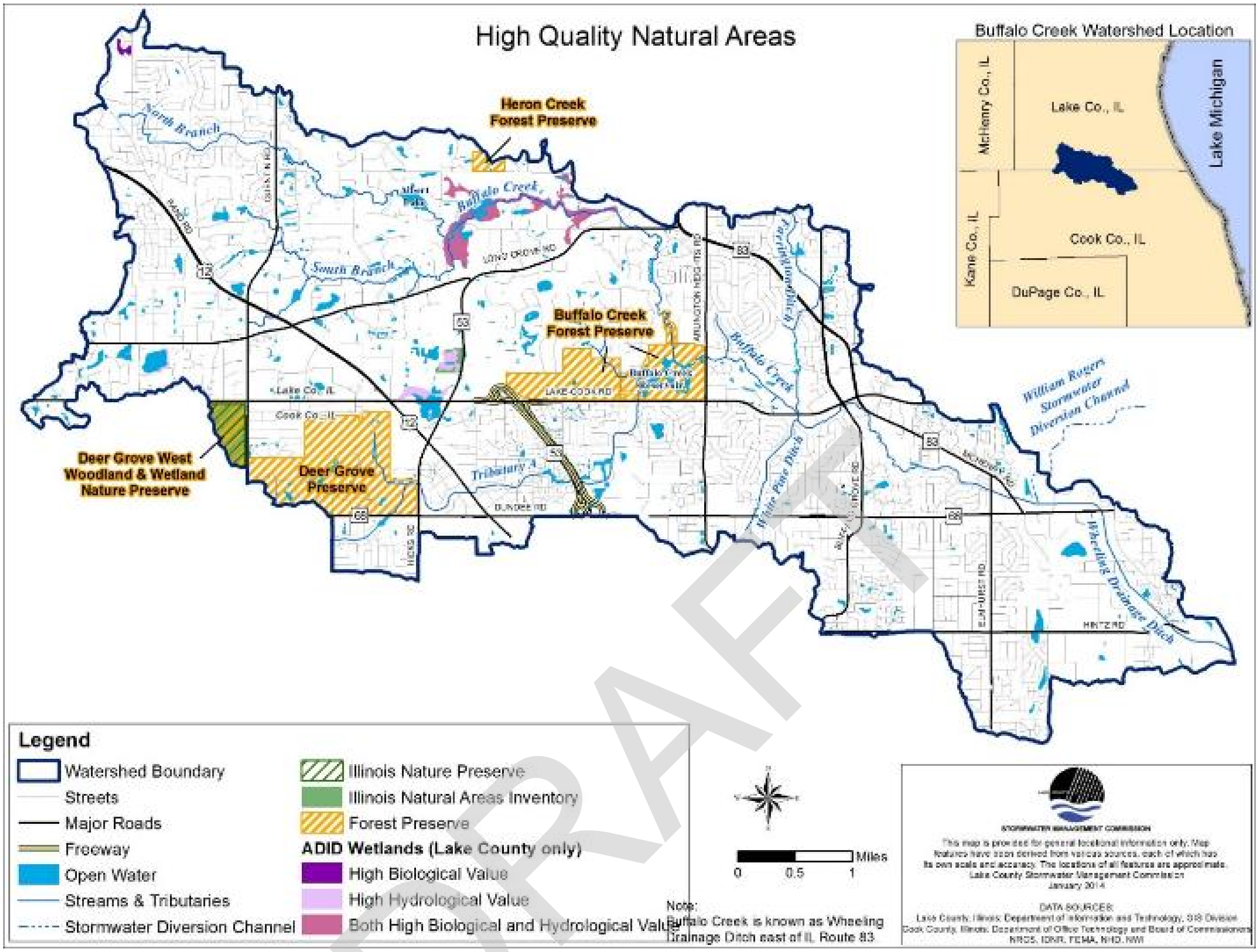


Figure 3-29: High Quality Natural Areas in the Buffalo Creek Watershed.

3.9.3 Wetland Inventory

Wetlands provide a variety of functions. They provide areas where groundwater is recharged by surface water and where groundwater is discharged to the land surface. They also filter sediments and nutrients in runoff, provide wildlife habitat, reduce flooding, and help maintain water levels in streams. These functions improve the water quality and biological health of downstream waterbodies, making wetlands a valuable watershed management tool.

European settlers to the region altered much of the Buffalo Creek Watershed's natural hydrology and wetland processes. Settlers drained wet areas, channelized streams, and cleared forests in order to farm the rich soils. Even after being cleared or drained, the underlying soil retains its characteristics. Hydric soils (soils that remain wet for an extended period of time) are a source used to identify pre-settlement wetlands. Based on hydric soils mapping, approximately 71% of the wetland land area that existed prior to European settlement has been lost in the Buffalo Creek Watershed (USEPA, 2015). Development of the Buffalo Creek Watershed has reduced the potentially restorable wetlands by 73%, with 1,019 acres of potentially restorable wetlands remaining on undeveloped land (USEPA, 2015).

Existing wetland locations are derived from two data sets – the Lake County Wetland Inventory (LCWI) and the National Wetlands Inventory (NWI) in Cook County. While the NWI is available for both counties, the LCWI was used in Lake County for this plan as it represents a more accurate representation of wetlands in the watershed. A summary of wetlands mapped in Lake and Cook county according to the NWI is presented in Table 3-18. All wetlands in the Buffalo Creek Watershed are classified in the NWI as either lacustrine (deepwater habitats lacking trees, shrubs, and ***emergent plants***) or palustrine (an area dominated by trees, shrubs, and emergent plants.

Table 3-18: National Wetland Inventory Summary for Buffalo Creek Watershed.

NWI Classification	# of Wetlands Cook County	Acres in Cook County	# of Wetlands Lake County	Acres in Lake County
Lacustrine Limnetic	1	17.18	2	9.71
Palustrine Aquatic Bed	-	-	5	4.11
Palustrine Emergent/Aquatic Bed	-	-	1	1.54
Palustrine Forested/Emergent	2	6.84	4	39.56
Palustrine Scrub-Shrub/Emergent	2	2.81	5	39.73
Palustrine Emergent	41	194.91	111	224.88
Palustrine Forested/Scrub-Shrub	-	-	1	13.18
Palustrine Forested	8	13.18	11	29.35
Palustrine Scrub-Shrub	1	1.10	7	9.46
Palustrine Unconsolidated Bottom	85	91.18	112	165.86
TOTAL	140	327.20	259	537.38

Emergent Plants: *Plants that have their roots contained in shallow water with most of its vegetative growth above the water.*

Limnetic: *Deep water habitats greater than 6.6 feet deep.*

Aquatic Bed: *Includes wetlands and deeper water habitats dominated by plants that grow on or below the surface.*

Forested: *Areas where woody vegetation is taller than 20 feet and covers more than 30% of an area.*

Scrub-Shrub: *Areas where woody vegetation is shorter than 20 feet and covers more than 30% of an area.*

Unconsolidated Bottom: *Wetlands in which the substrate is at least 25% particles smaller than stones, has greater than 30% vegetative cover, and is permanently flooded.*

Noteworthy: Identifying High Quality Natural Resources

The Illinois Natural Heritage Database provides information on the presence of the state's threatened and endangered plants and animals, exceptional natural communities and special geological features. The database has compiled information from a broad range of sources, including museum and herbarium collection records, publications, and experts throughout the state. Guided by this information, the Division of Habitat Resources participates in considerable field surveys every year to build the database and keep it current. Staff members, contractors, and volunteers perform field surveys to find and verify specific locations of the features of highest priority and to collect accurate information on the condition, quality, and management needs of these features. Scientists, resource managers, and volunteers contribute to the database. Major contributors include the IDNR, Nature Conservancy, Illinois Natural History Survey, Morton Arboretum, Southern Illinois University-Carbondale, Eastern Illinois University, Illinois State Museum, Illinois Nature Preserves Commission, and the Illinois Endangered Species Protection Board.

Illinois Sustainable Natural Areas Vision (SNAV): The SNAV is the corollary to the Illinois Natural Areas Plan written in 1980 following the completion of the first INAI. The primary goal of this first plan was to protect existing INAI sites and manage them to sustain them into the future. The primary goal of SNAV is to set forth a workable, implementable framework for creating a sustainable, connected system of natural areas. In the short term, efforts will be made to protect natural areas as they exist today, encompassing all the current ecological functions and biodiversity of these sites. Secondary goals include the identification of the potential roles of all stakeholders in this effort, and to consider the many challenges and opportunities that exist in protecting natural areas and creating sustainability.

Illinois Nature Preserves: State-protected areas that are provided the highest level of legal protection, and have management plans in place.

The LCWI was updated in 2002 using high resolution aerial photography and enhanced topographic information. The LCWI identifies five categories of wetlands including: wetlands, farmed wetlands, artificial wetlands, converted wetlands, and Advanced Identification (ADID) wetlands. The ADID was developed by the USEPA et al. in 1992 and identified high functionality wetlands that should be protected. Three primary functions were used to evaluate wetlands during the ADID process: biological functions (i.e., threatened or endangered species, wildlife habitat, and plant species diversity), hydrologic functions (i.e., stormwater storage), and water quality mitigation functions (i.e., sediment and toxicant retention, shoreline/bank stabilization). ADID wetlands are assessed to determine locations appropriate for preservation, restoration, and management options. Potential wetland restoration sites are discussed in Chapter 7.

There are approximately 1,576 acres of mapped wetlands remaining in the watershed (Tetra Tech, 2015), with approximately 208 acres identified in Lake County classified as ADID wetlands. It should be noted that the NWI identified approximately 537 acres in Lake County. The ADID process identifies wetlands of high value based on their habitat, water quality, and stormwater storage functions. The locations of mapped wetlands in the Buffalo Creek Watershed are shown in **Figure 3-30.** There is a 149 acre wetland complex located downstream of Albert Lake that is of both high biological and hydrological value. The remaining 53 acres of ADID wetlands are scattered throughout the watershed and are of high hydrological value. A 6 acre wetland in the northwest corner of the watershed has high biological value.

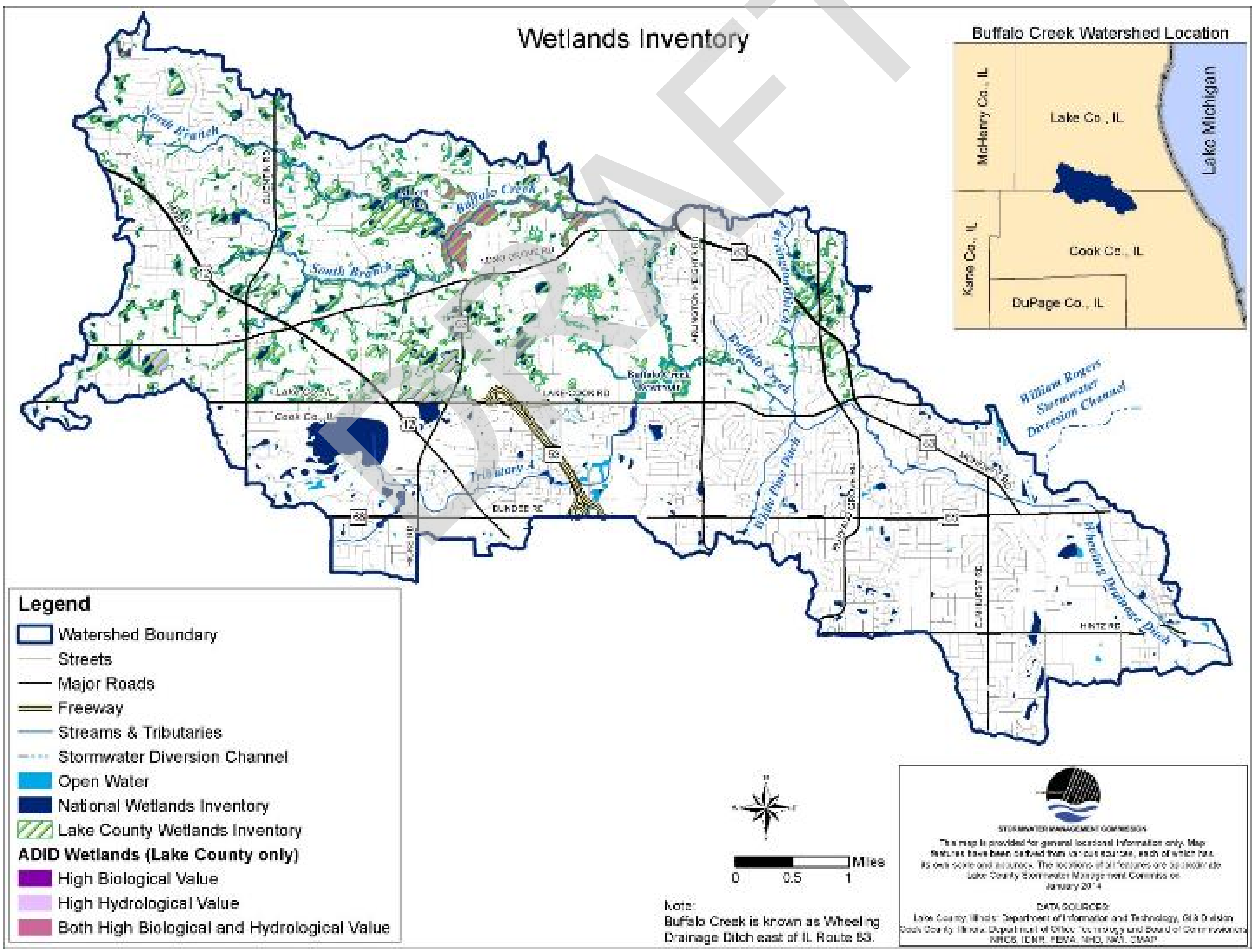


Figure 3-30: Wetlands Inventory for the Buffalo Creek Watershed.

Based on the NWI, there are 140 wetlands totaling 327 acres in the Cook County portion of the watershed. Deer Grove East contains recently restored wetlands and prairie, including 23 wetlands restored by disabling drain tiles that drained former farm fields at the site. Deer Grove East contains the largest wetland in the Cook County portion of the watershed.

Noteworthy: Wetland Classifications Systems

The Advanced Identification (ADID) process involved collecting information on the values and functions of wetlands identifying those of high value based on their habitat, water quality, and stormwater storage functions. The EPA conducts the process in cooperation with the USACE, USFWS and local and regional agencies. Designation as an ADID wetland results in a more rigorous permitting review when impacts such as filling are proposed. As a result, alterations of ADID wetlands are strongly discouraged. The ADID wetlands inventory was completed for Lake County in 1992 and updated in 2002.

The NWI was established by the USFWS to conduct a nationwide inventory of U.S. wetlands to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. To do this, the USFWS developed a wetland classification system (Cowardin et al. 1979) that is now the official USFWS wetland classification system and the Federal standard for wetland classification. The NWI is a database of information used to identify the status of wetlands across the United States. The system contains wetland data in map and digital formats. Wetlands are classified into five major systems (according to the Cowardin system): marine, estuarine, riverine, lacustrine, and palustrine.

3.10 Watershed Drainage System

3.10.1 Hydrology and Flow

Hydrology is the study of the occurrence, circulation, distribution, and properties (e.g., quality) of the earth's water. A central theme of science is that the earth's water is constantly being cycled – between the ocean, the air, and the land – through different pathways and at different rates. The movement of the earth's water through these various pathways is called the hydrologic cycle.

Stormwater Runoff: *Water from rain or melting snow that "runs off" across the land instead of seeping into the ground. Generally speaking, stormwater is rain (also melting snow and ice) that washes off driveways, parking lots, roads, yards, rooftops, and other hard surfaces.*

Although the hydrologic cycle is inherently complex, one can gain a general understanding of how it works by envisioning the following process. Clouds form over the ocean due to the evaporation of water. Wind carries the clouds ashore where they produce rain. Excess rainfall (i.e., ***stormwater runoff***) flows into lakes, rivers, and wetlands. Over time, water stored in the lakes, rivers, and wetlands, either evaporates back into the atmosphere or flows back into the ocean, beginning the cycle anew. A graphic representation of the hydrologic cycle is shown in Figure 3-31.

Primarily, hydrology involves studying the flow of water between its various states – or within a given state – through the various hydrologic pathways that can be found within a particular geographical region or area. These pathways connect every component of the landscape with every other and can generally be divided into two categories: surface water hydrologic pathways, which include all of the hydrologic pathways that can be found at or above the land surface (e.g., precipitation, interception, evapotranspiration, surface water flow); and, ground water hydrologic pathways, which include all of the hydrologic pathways that can be found below the land surface (e.g., infiltration, interflow, groundwater flow). The study of the surface water hydrologic pathways that connect the various parts of the landscape is known as surface water hydrology, while the study of the ground water hydrologic pathways that connect the various parts of the landscape is known as hydrogeology. Primary areas of study within the science include developing methods for directly measuring flows through the various hydrologic pathways

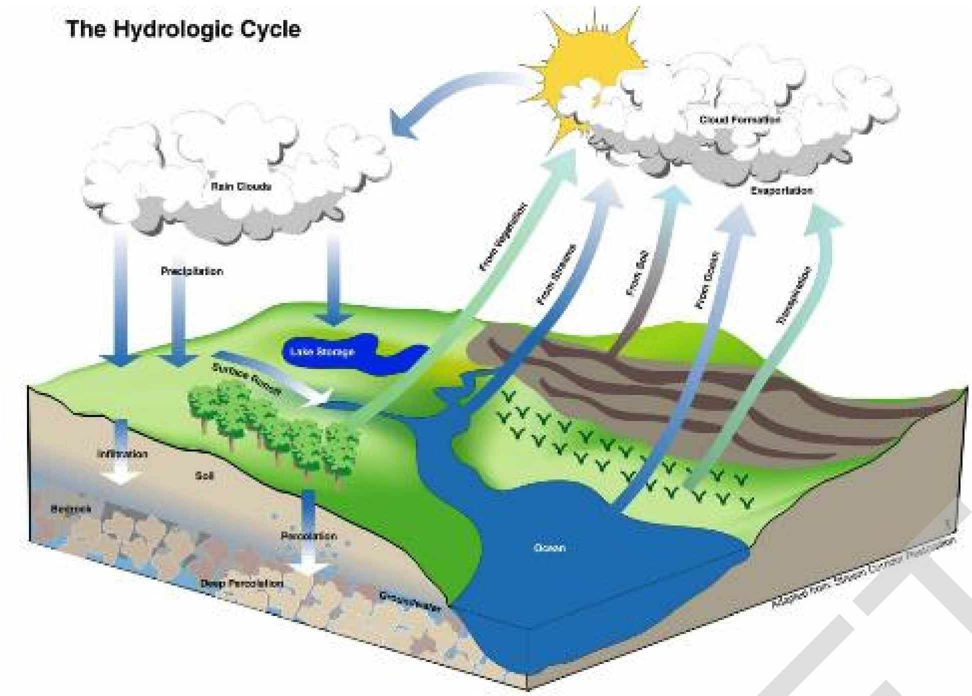


Figure 3-31: The Hydrologic Cycle (Source: Department of Natural Resources Ecology and Management at Iowa State University. Tom Schultz).

and developing and/or applying models for estimating flows through the various hydrologic pathways, either for scientific knowledge or for making predictions.

When applied to a watershed, hydrology typically involves studying the flow of water between the surface water hydrologic pathways that connect the air, the land, and the lakes, rivers, and wetlands found within the watershed. Such investigations usually begin with a delineation of the watershed. As discussed in Section 3.1.1 (Topography), the Buffalo Creek Watershed was originally delineated by the USDA NRCS and was refined by the USACE as part of their Des Plaines Phase II planning efforts. The watershed boundary was further revised by Cardno during the watershed planning process to include areas within Lake Zurich that are tributary to Buffalo Creek via storm sewer and to remove a portion of the Deer Grove Forest Preserve that is actually tributary to Salt Creek. Once the watershed boundary is determined, a combination of desktop assessment and field reconnaissance work can then be performed to investigate the surface water hydrology of the watershed. Such investigations usually include identification of surface water inputs to the watershed, surface water outputs from the watershed, and surface water flow paths within the watershed. Understanding how water moves and flows is an important component of understanding a watershed. All of the parameters listed in the previous sections (i.e. topography, soils, precipitation and land use) impact hydrology. Hydrological data are available from the USGS website (www.usgs.gov). The USGS maintains stream gages throughout the United States and they monitor conditions such as gage height and stream flow, and at some locations, precipitation. The Buffalo Creek USGS stream gage (05528500) is located in the central portion of the watershed near Wheeling, and includes data from 1953 to 2013. Figure 3-32 displays the location of the USGS gaging station. Buffalo Creek's highest average annual stream flow of 35 cubic feet per second (cfs) was recorded in 2007, while the lowest average annual stream flow (2 cfs) was recorded in 1963 (see Figure 3-33). April has the highest average monthly discharge for Buffalo Creek, while October has the lowest average monthly discharge (see Figure 3-34)

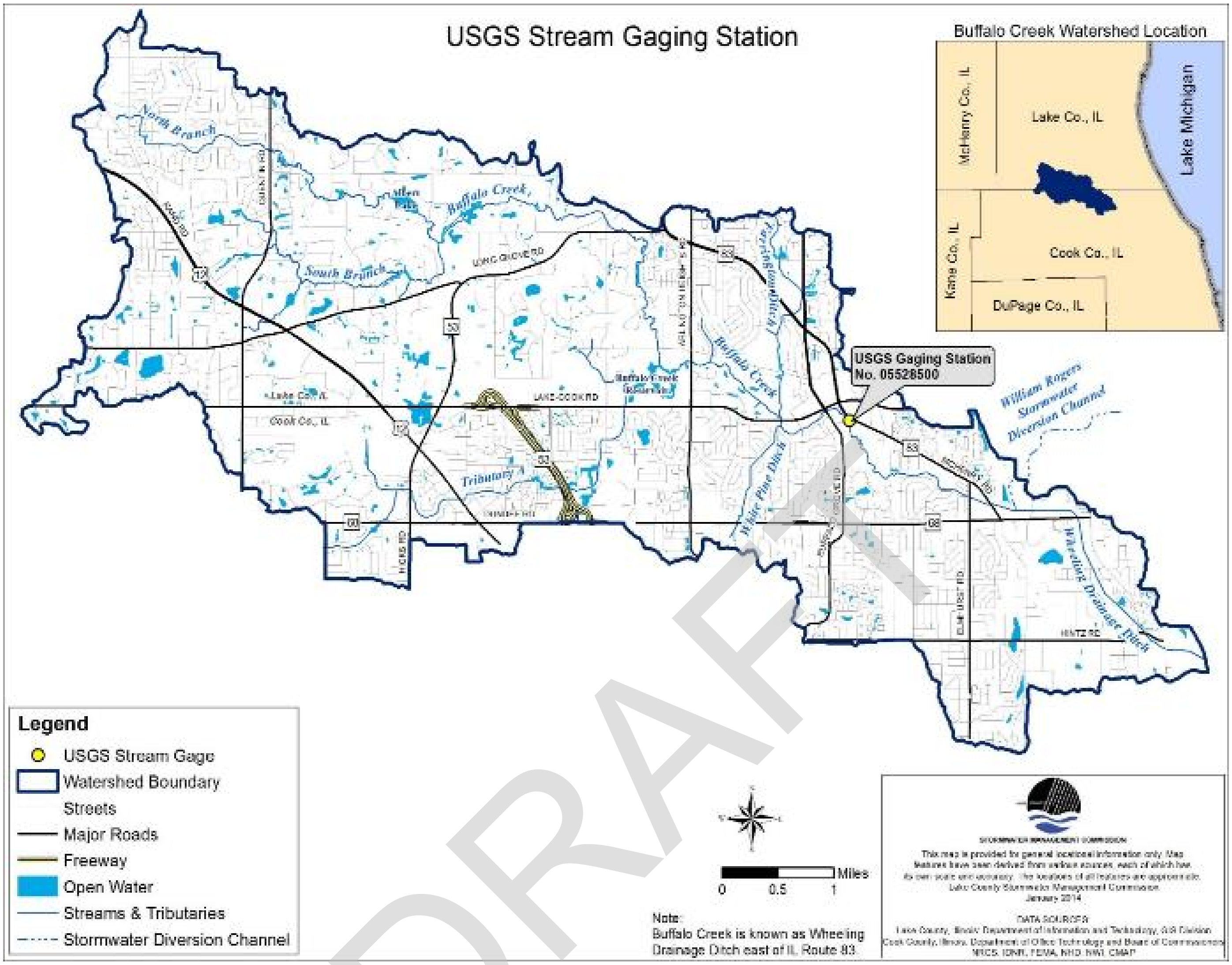


Figure 3-32: USGS Stream Gaging Station in the Buffalo Creek Watershed.

Noteworthy: Hydrologic Cycle

The hydrologic cycle describes the continuous movement of water on, above, and below the surface of the earth. The total mass of water on earth remains fairly constant over time, but how much of that water is found in each of its three primary states: solid (i.e., ice), liquid (i.e., water), and gas (i.e., water vapor), is variable depending on a wide range of climate-related variables. Water moves from one state to another – and across the surface of the earth – through various hydrologic pathways, such as evaporation, transpiration, condensation, precipitation, infiltration, surface water flow, and interflow (i.e., shallow groundwater flow).

As water moves from one state to another, such as from water vapor to water (i.e., rain), energy is exchanged, which affects temperatures on the surface of the earth. For example, when water evaporates, energy is absorbed and the surface of the earth is cooled through the process of evaporative cooling. When it condenses, energy is released and the surface of the earth is warmed (see Figure 3-31). These energy exchanges, which take place on a global scale, powered by solar energy, have a significant influence on the earth's climate, as does water, in its three primary states (e.g., water vapor is the most important greenhouse gas, absorbing and emitting energy back toward the surface of the earth, but, in the form of clouds, also works to reflect a significant amount of solar radiation back into space). Water and the hydrologic cycle are responsible for earth's mild climate and makes life possible for all creatures found upon, below, and above its surface.

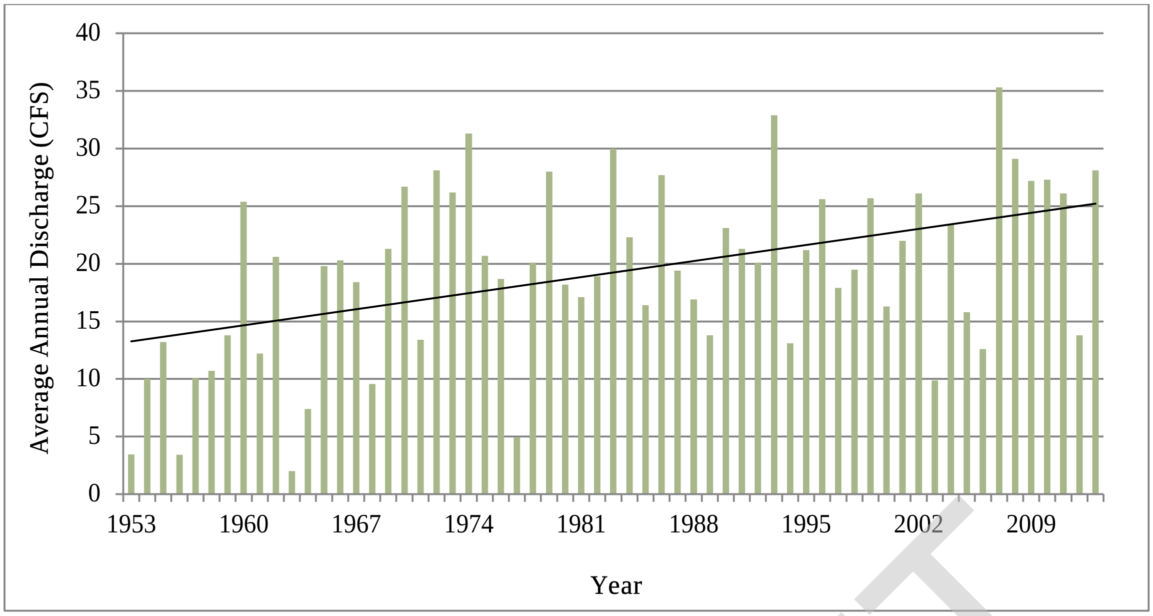


Figure 3-33: Average Annual Stream Flow (CFS), USGS Buffalo Creek Stream Gage.

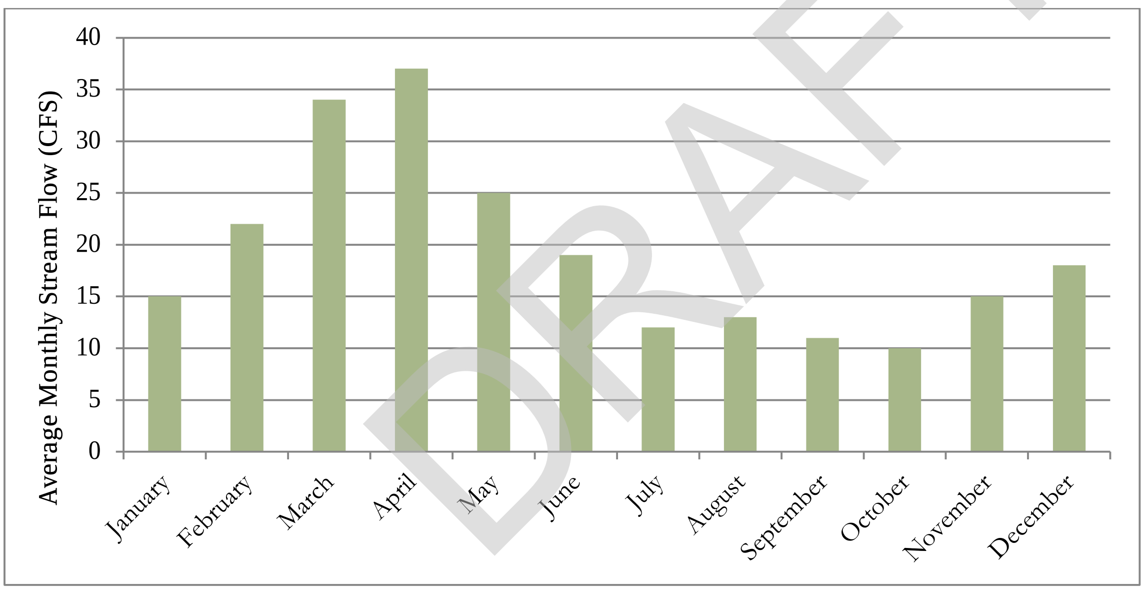


Figure 3-34: Average Monthly Stream Flow (CFS), USGS Buffalo Creek Stream Gage from 1953 through 2013.

Within the Buffalo Creek Watershed surface water generally flows from northwest to southeast, with the highest elevations found in the northwest corner of the watershed, and the lowest found in the southeast. Along the way, surface water passes through various streams, lakes, wetlands and detention/retention ponds that were further investigated and are described in more detail in the following sections. Major surface water inputs include inflow from streams (such as the Farrington Ditch, White Pine Ditch, Tributary A and the North Branch/South Branch of Buffalo Creek) and precipitation. Major surface water outputs include outflow (i.e. an overflow weir on the north side of Buffalo Creek conveys flood waters to the William Rogers Memorial Diversion Channel in Wheeling, which joins the Des Plaines River east of Milwaukee Avenue) and ***evapotranspiration***.

Evapotranspiration: *The evaporation from soils, plant surfaces, and water bodies and water losses through plant leaves.*

3.11 Constructed Drainage Systems

As European settlers converted the watershed's natural landscape to agriculture, they improved the drainage of wetland (hydric) soils by using underground drain tiles and ditches. Likewise, as land owners today convert natural and farmed lands to residential, industrial, and commercial land uses they improve the drainage of the landscape with storm sewer systems and stormwater storage facilities (detention basins), to maximize the land's development potential and to reduce the likelihood of flooding problems

3.11.1 Agricultural Drain Tile Network

The natural drainage system of overland flow paths and wetlands draining into streams, lakes, and watersheds began to change when European settlers discovered the potential agricultural productivity of the soils in the area. Most of these soils remained wet for several days following a rain event, which causes significant problems with crop production. Saturated soils do not provide sufficient aeration for crop root development and lead to crop stress.

Bankfull: *A point at which water flow in a stream fills the channel to the top of its banks just to the point where water begins to overflow on to the adjacent floodplain.*

Peak runoff: *The maximum amount of water being discharged at a specific location during a storm event.*

In the late 1800s, European settlers began using primitive agricultural drainage tile systems and ditches to remove standing or excess water from poorly drained lands. By the 1960s and 1970s, drainage tiles became the standard for removing unwanted water from the land. Drainage tiles ultimately carry water to ditches, streams, or lakes. Drainage systems generally accelerate the speed that runoff reaches receiving streams, thereby increasing peak flows and the duration of ***bankfull*** flows, which can lead to stream channel degradation (erosion downcutting and widening) and downstream flooding.

3.11.2 Storm Sewers System and Detention Basins

As settlement of the watershed area increased, the natural drainage system began to experience more changes as residential, commercial, and industrial land uses replaced open lands. These land use/cover changes limited the land's capacity to infiltrate and store precipitation and runoff. In the developed areas of the watershed, a storm sewer network drains runoff directly to a stream or lake, or into a detention basin, which collects and holds the water for a period of time before discharging it to a stream or lake. Undeveloped areas, lands used for agriculture, and many older residential developments do not have stormwater detention facilities as they were built before detention basins were required by ordinances.

Since early urban development was constructed without detention basins, runoff was directly sent to wetlands, lakes, streams, and rivers causing an increase in ***peak runoff*** discharge (see Figure 3-35). An increase in peak discharges usually results in increased flooding. Detention basins are designed to capture stormwater runoff from a surrounding development and release the water slowly over a given amount of time, thereby reducing peak flows. Limited release from the frequent storms allows for more close approximation of the bankfull flow capacity of stream channels. Although many flood problems are alleviated using this method, channel degradation can result as prolonged

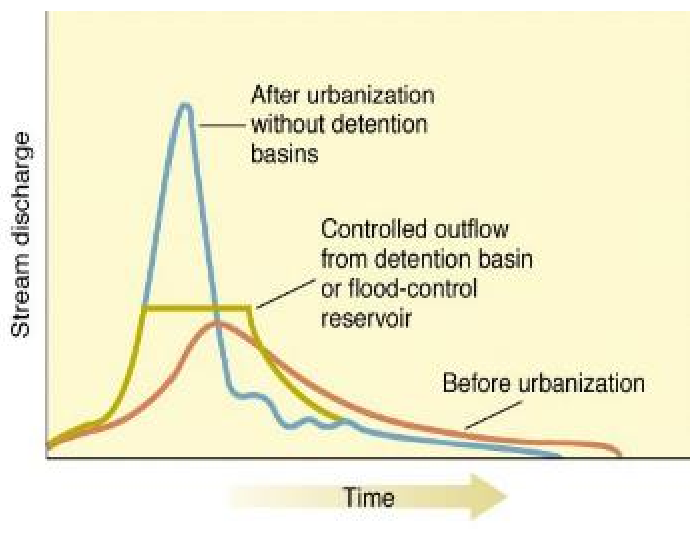


Figure 3-32: Hydrograph Example (Source: Carleton College Science Education Research Center).

bankfull flows cause ***streambank erosion***. In addition, while regulating the outflow from detention basins to the stream channel reduces peak flows, detention basins do not address the total volume of runoff. Consequently, flows from tributaries collect in mainstem river channels where the total volume of runoff results in flooding and flood damage.

Streambank erosion: *The removal of soil particles from the banks of a stream by the flow of water.*

Riparian Area: *Vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage.*

Defined Channel: *The bed where a natural stream of water runs.*

3.12 Stream Inventory

3.12.1 Introduction and Methods

Lake County Stormwater Management Commission (SMC) conducted a stream inventory of Buffalo Creek in the summer of 2013 to assess the current condition of the stream channel and ***riparian area***. The stream inventory is a largely qualitative assessment of several easily observed and measured parameters that can be analyzed individually or collectively to provide insight as to the present condition of the stream system. These data are also of use for documenting "baseline" conditions and prioritizing potential project needs and locations. For the purposes of the stream inventory, the entire stream network within the watershed was divided into reaches, which are smaller, geographically-defined segments of the stream for which data are aggregated and evaluated. Reaches ranged from approximately 765 feet to 4,670 feet in length. Dams, bridges, roads and railroad crossings are typically used to define the upstream and downstream limits of a reach. Each reach was assigned a unique identification code such as BC001 (Buffalo Creek Reach 1). The Buffalo Creek stream network and flow path was divided into 75 reaches (27.7 miles), of which 59 reaches (23.3 miles) were assessed in the inventory, 2 reaches (0.6 miles) were inaccessible due to construction, and 14 reaches (3.9 miles) lacked a defined channel, or were not streams (i.e., lakes, ponds, wetlands or engineered stormwater systems). The average length of assessed reaches in the Buffalo Creek inventory is 1,941 feet (less than ½ mile). A summary of the stream inventory assessment is located in Appendix C.

The stream inventory is designed to assess the condition of stream channels, therefore, data are collected only for reaches with a ***"defined" channel*** and that are safe to wade. Stream inventory data are not collected for open-water ponds, lakes and impoundments, wetland complexes with no defined channel, and areas where the depth of water and/or unstable substrate creates a hazard for the observer(s). Note that White Pine ditch was not assessed during the stream inventory as it is classified as a minor flow tributary/ditch with no associated name (according to the Cook County GIS data). Roadside swales and smaller minor tributaries were also not included as part of the inventory.

The following types of data were collected during the inventory and are discussed in detail in the following sections:

- Channel conditions (dimensions of the banks and bed)
- Channelization
- Pool-Riffle Development
- Bank Erosion
- Sediment Accumulation and Debris Loading
- Hydraulic Structures (bridges, culverts, dams, etc.…)
- Discharge Points (storm sewers, pipes, and overland flow draining to the stream)
- Riparian Corridor (vegetated buffer along the stream)

Data are collected by a team of two observers walking the entire length of every assessed reach. At representative points within each reach, the observers measure the channel dimensions and relative velocity (at the surface) of the stream. The observers photograph and document areas of moderate to severe ***erosion***, significant ***sediment deposition*** and debris jams, all ***hydraulic structures***, all ***discharge points***. Photos and measurements of the stream channel also document conditions that are representative of the reach. Because the observers use a camera that is equipped with a ***global positioning system (GPS)***, each photo is tagged with geographic coordinates that are translated into point locations in a GIS during post-processing. This manner of conversion allows for analysis and mapping of the collected data.

Erosion: *The process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves*

Sediment Deposition: *The geological process in which sediments, soil and rocks are added to a landform or land mass.*

Hydraulic Structures: *Bridges, culverts, dams, weirs, or other structures spanning or crossing the stream channel.*

Discharge Points: *The location where stormwater flows back into a lake or stream channel*

Global Positioning System (GPS): *A system of earth-orbiting satellites, transmitting signals continuously towards the earth, that enables the position of a receiving device on or near the earth's surface to be accurately estimated from the difference in arrival times of the signals.*

3.12.2 Stream Network Descriptions

The Buffalo Creek Watershed contains approximately 27.7 miles of flow path through streams, wetlands, and lakes, (of which 23.2 miles of stream channel were assessed during the stream inventory), as shown in Figure 3-36 and Table 3-19. The network of stream channels in the watershed includes natural meandering channels, channelized or straightened segments of natural streams and wholly constructed channels or ditches that were created primarily to drain land. In addition to the stream network, these channels are connected to an array of wetlands, lakes, and impoundments. For the purposes of discussion in this section, the areas assessed during the stream inventory are divided into 4 geographic sections (see Figure 3-36):

1. Buffalo Creek Mainstem: Originates in Long Grove at the confluence of the North and South Branches of Buffalo Creek.
2. North Branch of Buffalo Creek: One of the two branches that merge to form the Buffalo Creek Mainstem, originating in Lake Zurich.
3. South Branch of Buffalo Creek: One of the two branches that merge to form the Buffalo Creek Mainstem, originating in Kildeer.
4. Tributary A: Originates in Cook County, just east of Deer Grove Forest Preserve. Flows north under Lake Cook Road into the Buffalo Creek Reservoir.
5. Farrington Ditch: Tributary originating from Green Knolls Park Pond (and receiving drainage from two other residential detention facilities) draining south, parallel to Buffalo Grove Road in Buffalo Grove.

Table 3-19: 2013 Stream Inventory Miles in the Buffalo Creek Watershed.

	Buffalo Creek Mainstem	North Branch of Buffalo Creek	South Branch of Buffalo Creek	Tributary A	Farrington Ditch	Total
Number of Reaches	24	7	13	10	5	59 Reaches
Assessed Miles	10.0	3.0	4.2	4.0	2.1	23.3 Miles

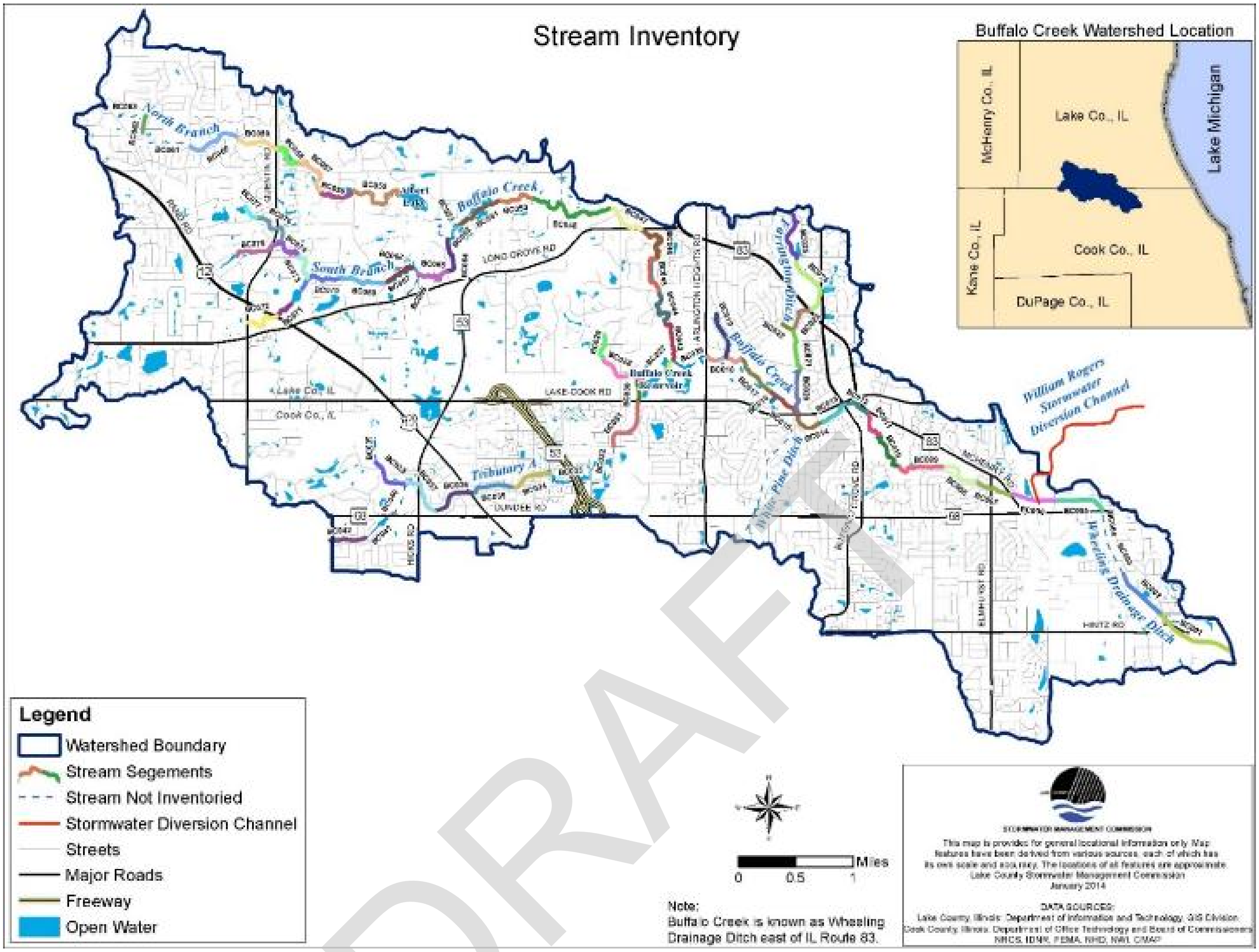


Figure 3-36: 2013 Stream Inventory Stream Reaches in the Buffalo Creek Watershed.

3.12.2.1 Channel Conditions

Measurements of the physical dimensions of the stream channel reflect both the shape of the channel as well as the amount of water that it can transport under ***low and high flow conditions***, as shown in Table 3-20. The Buffalo Creek Mainstem and the South Branch of Buffalo Creek have large channels relative to the other tributaries in the watershed. This pattern of narrow-shallow headwater streams gradually draining into wider-deeper mainstem streams is common in stream hydrology.

> ***Low or High Flow Conditions:***
> *Typically measured as a 7 day average of the lowest or highest water flow rates annually.*

3.12.2.2 Channelization

Channelization refers to the straightening of natural, meandering stream channels or the construction of channels for drainage or navigation, although no channels in the Buffalo Creek Watershed have been altered or constructed to improve navigation. In natural meandering streams, channelization has the effect of reducing the overall length of the stream and increasing the gradient of the channel. In both streams and constructed channels, channelization increases the speed at which runoff flows through the stream system. Because it is the nature of concentrated, flowing water to create meandering channels with over-bank floodplains that dissipate the energy of the flowing water, channelized streams may be susceptible to bank instability and erosion.

Table 3-20: 2013 Stream Inventory - Channel Conditions in the Buffalo Creek Watershed.

Stream Segment	Bank Height (ft.)		Channel Width, Top (ft.)		Channel Width, Bottom (ft.)	
	Min.	Max.	Min.	Max.	Min.	Max.
Buffalo Creek Mainstem	0.3	15.0	7.0	70.0	0.83	45.2
North Branch of Buffalo Creek	0.1	3.2	4.5	61.5	2.5	45.0
South Branch of Buffalo Creek	0.1	16.0	3.6	130.0	1.5	36.0
Tributary A	0.25	7.5	0.67	75.0	0.7	27.5
Farrington Ditch	0.1	3.5	0.1	75.0	0.1	27.0

Figure 3-37 and Table 3-21 illustrates the degree of channelization of assessed reaches in the Buffalo Creek Watershed. The reaches of Buffalo Creek upstream of the Buffalo Creek Reservoir primarily have a low to moderate degree of channelization. The areas with the highest degree of channelization are Farrington Ditch and the section of Buffalo Creek located east of Elmhurst Road (known as Wheeling Drainage Ditch). Farrington Ditch is a channelized ditch that runs through the backyards of many homes and also through the Buffalo Grove Golf Course and Willow Stream Park Frisbee disc course. Farrington Ditch is primarily surround by mowed turf grass with very little buffer. Streams such as Farrington Ditch that are channelized have reduced ***instream habitat*** and stability.

Instream Habitat: *Within a stream, the environment in which an animal or plant normally lives or grows.*

Table 3-21: 2013 Stream Inventory - Degree of Channelization in the Buffalo Creek Watershed.

Degree of Channelization	North Branch			South Branch			Buffalo Creek Mainstem			Tributary A			Farrington Ditch		
	Reaches	Miles	% of Miles	Reaches	Miles	% of Miles	Reaches	Miles	% of Miles	Reaches	Miles	% of Miles	Reaches	Miles	% of Miles
None	3	1.49	50%	9	2.84	67%	4	2.04	21%	1	0.36	9%	1	0.34	16%
Low	4	1.49	50%	2	0.86	20%	9	3.15	32%	2	0.94	24%	1	0.6	29%
Moderate	0	0	0%	1	0.37	9%	6	2.28	23%	6	2.35	59%	0	0	0%
High	0	0	0%	1	0.16	4%	5	2.48	25%	1	0.32	8%	3	1.15	55%
Total	7	2.98	100%	13	4.2 3	100%	24	9.95	100%	10	3.97	100%	5	2.09	100%

Photos of channelized (left) and natural (right) stream reaches in the Buffalo Creek Watershed.

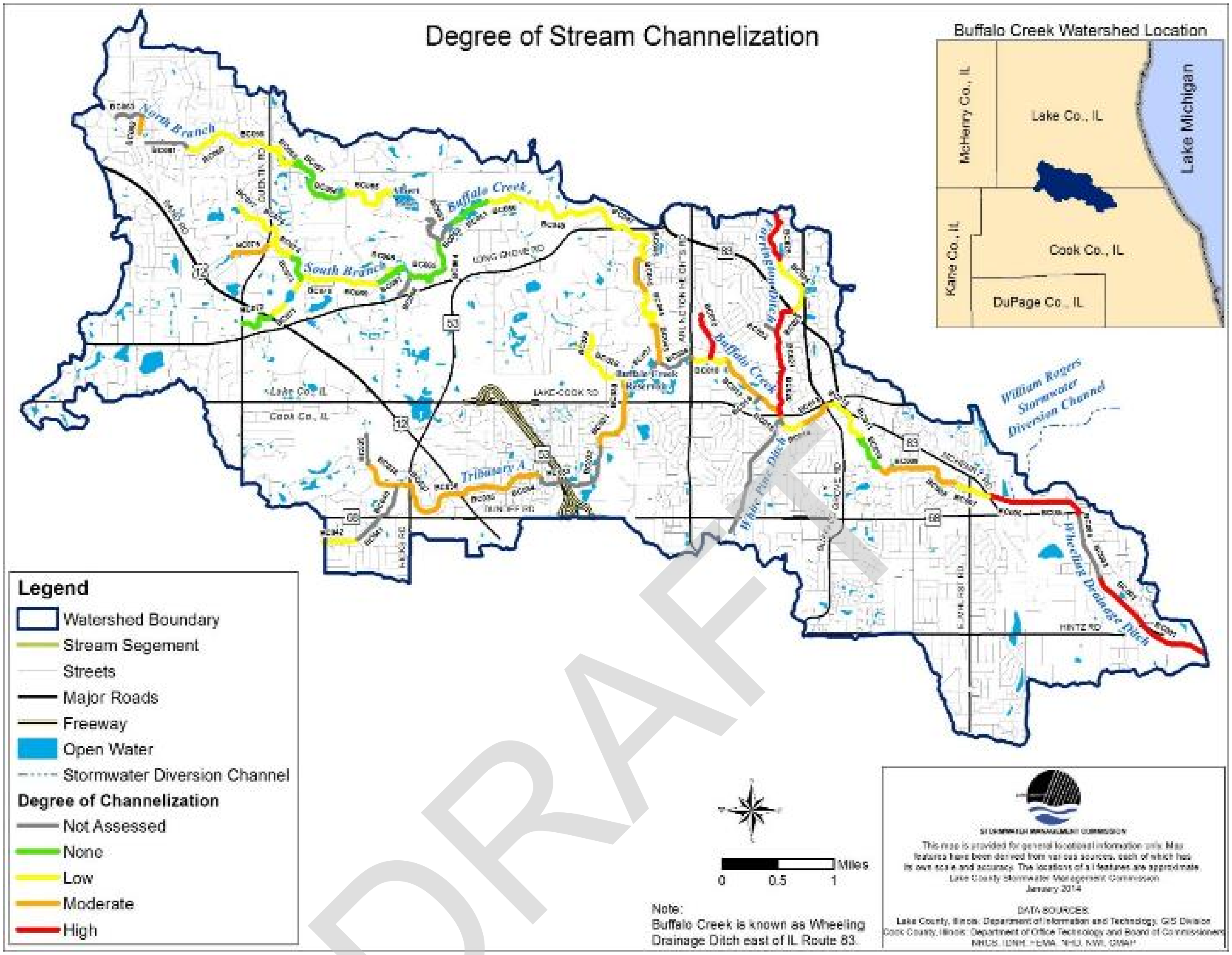


Figure 3-37: 2013 Stream Inventory - Degree of Channelization in the Buffalo Creek Watershed.

3.12.2.3 Pool-Riffle Development

Pool-riffle development refers to the degree to which naturally-undulating stream bed topography is present in a reach. Natural, meandering streams develop sequences of deeper bowl-shaped “holes,” or pools, as well as steeper shallow areas, or riffles. Streams also develop relatively straight sections between pools and riffles called “runs”. Pools, riffles, and runs all provide an array of ecosystem services in streams (aeration, refuge, spawning and nursery areas, foraging areas, etc.). Pool/riffle development may be low or absent in channelized or modified stream reaches.

The stream inventory noted a difference in pool-riffle development for Farrington Ditch, the North and South Branches of Buffalo Creek and the mainstem, as shown in Table 3-22 and Table 3-23. As might be expected, the mainstem and the North Branch of Buffalo Creek, which both contain significant portions of natural stream channel, have more pool-riffle development than the constructed and channelized Farrington Ditch.

Table 3-22: 2013 Stream Inventory - Pool Development in the Buffalo Creek Watershed.

Degree of Pool Development	North Branch		South Branch		Buffalo Creek Mainstem		Tributary A		Farrington Ditch	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%	Reaches	%
None (<5%)	3	51%	7	57%	9	35%	7	67%	5	100%
Low (5-33%)	3	33%	4	35%	13	57%	3	33%	0	0%
Moderate (34-66%)	1	16%	1	3%	2	8%	0	0%	0	0%
High (>67%)	0	0%	1	4%	0	0%	0	0%	0	0%
Total	7	100%	13	100%	24	100%	10	100%	5	100%

Table 3-23: 2013 Stream Inventory - Riffle Development in the Buffalo Creek Watershed.

Degree of Riffle Development	North Branch		South Branch		Buffalo Creek Mainstem		Tributary A		Farrington Ditch	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%	Reaches	%
None (<5%)	4	56%	7	57%	7	36%	8	80%	5	100%
Low (5-33%)	3	44%	6	43%	12	43%	2	20%	0	0%
Moderate (34-66%)	0	0%	0	0%	5	21%	0	0%	0	0%
High (>67%)	0	0%	0	0%	0	0%	0	0%	0	0%
Total	7	100%	13	100%	24	100%	10	100%	5	100%

Noteworthy: Stream Geomorphology

Streambank erosion is a natural process and contributes to the meandering form often associated with natural streams. Common channel patterns include straight, meandering, braided and anastomosing. Each of these channel patterns is distinguished based on the sinuosity or "wiggliness" of the channel. Stream morphology is naturally formed by a balance between the amount of material eroded from one streambank and the amount of material deposited on another streambank. Streams naturally have pool-riffle sequences (see Figure 3-38), which are a result of the stream pattern. Pools are an area of deeper, slower moving water, with fine bed materials. Riffles on the other hand contain coarser bed materials and shallow faster moving water. Pool-riffle sequences are generally found in natural meandering streams, with pools located in the outside bend and riffles located at crossover stretches. Riffle-pool sequences provide unique habitats that support a diverse community of aquatic organisms. Riffles generally provide increased water velocities and oxygen that supports filter feeding macroinvertebrates, while pools provide habitat for larger fish during low flow conditions. Streams naturally shift and change shape over time based on the geological history, stream slope, discharge and sediment load.

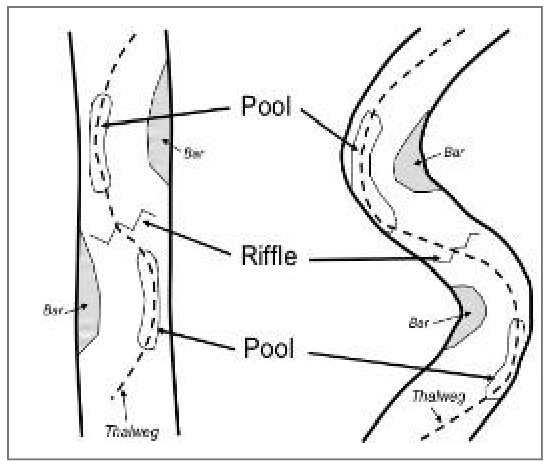


Figure 3-38: Graphic Depicting Pool and Riffle Sequences in a Stream. Source: Michigan State University – Watershed Management Short Course.

3.12.2.4 Aquatic Habitat and Substrate

Substrate refers to the materials that rest on the bottom of the stream (streambed). Documentation of the substrate composition and stability in streams assists with understanding the stream's ability to withstand erosion and the benthic (or stream bottom) habitat it provides. The primary substrate found in Buffalo Creek is gravel followed by sand, ***silt***, ***cobble***, and ***organic matter***. The majority of the substrates in Buffalo Creek are highly stable (see Table 3-24). Farrington Ditch substrates are dominated by organic matter followed by silt, sand and concrete. The substrate materials present in Farrington Ditch provide little substrate stability. The primary substrates found in the North Branch of Buffalo Creek are sand followed by ***claypan***, gravel, organic matter, and silt. These substrate materials provide the majority of the stream with high stability, however, there is a large portion of the stream with low streambed stability. The primary substrates found in the South Branch of Buffalo Creek and Tributary A are gravel followed by sand, silt, organic matter, and cobble. Most of the South Branch of Buffalo Creek and Tributary A has no or low streambed stability.

Aquatic organisms such as fish, macroinvertebrates, freshwater mussels and amphibians often have specific habitat requirements. These habitat requirements are often required for feeding, refuge or reproduction. In 2013 the presence of stream habitat features such as undercut banks, deep pools, ***macrophytes***, logs, overhanging vegetation, ***root wads***, boulders, and ***backwaters*** were documented for each stream segment of the Buffalo Creek Watershed. The North and South Branches of Buffalo Creek, Buffalo Creek mainstem, and Tributary A each had at least one stream segment containing one of the habitats listed in Table 3-25. However, Farrington Ditch did not have any stream segments containing deep pools, logs, root wads, or boulders. This data indicates that Farrington Ditch has the lowest habitat diversity.

Silt: *A sedimentary material consisting of grains or particles of disintegrated rock, smaller than sand and larger than clay.*

Cobble: *A rock fragment, often rounded, with a diameter of 64–256 mm, smaller than a boulder but larger than a pebble*

Organic Matter: *Matter composed of organic compounds that has come from the remains of organisms such as plants and animals and their waste products in the environment.*

Claypan: *A layer of stiff impervious clay situated just below the surface of the ground, which holds water after heavy rain.*

Macrophytes: *A plant, especially a marine plant, large enough to be visible to the naked eye.*

Root Wads: *A combination of interlocking tree materials where a mass of tree roots is utilized with other tree parts and revegetation methods to stabilize streambanks and provide aquatic habitat.*

Backwater: *A body of stagnant water connected to a river.*

Table 3-24: 2013 Inventory of Stream Substrate Stability in the Buffalo Creek Watershed.

Substrate Stability	North Branch	South Branch	Buffalo Creek Mainstem	Tributary A	Farrington Ditch
None	0%	35%	0%	30%	58%
Low	18%	32%	13%	29%	0%
Moderate	50%	19%	36%	21%	0%
High	32%	13%	52%	20%	42%

Table 3-25: Percentage of Stream Segments Containing In-Stream Cover Habitats in the Buffalo Creek Watershed.

Stream Segment	Undercut Banks	Deep Pools	Macro-phytes	Logs	Over hanging Vegetation	Root Wads	Boulders	Backwaters
North Branch	86%	50%	33%	86%	86%	29%	100%	78%
South Branch	51%	43%	24%	54%	51%	42%	54%	29%
Buffalo Creek Mainstem	89%	78%	63%	68%	83%	58%	85%	36%
Tributary A	52%	13%	33%	52%	62%	43%	43%	39%
Farrington Ditch	29%	0%	29%	0%	58%	0%	0%	29%

3.12.2.5 Streambank Erosion

> ***Armoring:*** *Installation of a safeguard or protection.*
>
> ***Turbidity:*** *A measure of water clarity based on the amount of sediment suspended in the waterbody.*

Streambank erosion is a function of the amount of water flowing along the bank, steepness of the bank, vegetative cover or ***armoring*** on the bank, and the material (earth) of which the bank itself is composed. Streambank erosion is a natural process and contributes to the sinuous, meandering form often associated with natural stream channels. In these relatively natural systems, there is typically an overall balance between the amount of material eroded from one streambank and the amount of sediment deposited on another (see Figure 3-39). However, in watersheds with significant human development, streambank erosion rates are often exacerbated by changes in watershed hydrology, leading to several problems. Erosion can cause physical water quality problems such as increased or excessive ***turbidity*** (cloudiness) in the water and sedimentation, which can "choke" stream channels, reducing the volume that can be conveyed and covering streambed materials such as gravel, which are important for aquatic organisms. Additionally, erosion can lead to chemical water quality problems because nutrients, phosphorus in particular, are often bound to sediment particles and introduced to the aquatic environment by erosion. Excessive erosion can be problematic for property owners and land managers because it can lead to the loss of land, property, or structures.

Photo of a streambank experiencing severe erosion in the Buffalo Creek Watershed.

The Buffalo Creek stream inventory assessed the degree of streambank erosion along the right and left bank (facing upstream) for each assessed stream, as shown in Table 3-26 and Figure 3-40. Because all streambanks are assumed to have some degree of erosion, reaches were rated as having slight, moderate, or severe erosion for each bank. The qualitative assessment criterion for each rating is given below. Approximately 87,824 linear feet were moderately eroded and 19,872 linear feet were severely eroded. The results indicate that nearly all stream reaches are moderately or severely eroded, suggesting that the stream channel may be adjusting to overall changes in watershed hydrology. The Buffalo Creek mainstem, the North and South Branches of Buffalo Creek, and Tributary A have the largest number of moderate or severely eroded streambanks. Farrington Ditch has a limited number of moderately eroded banks and no severely eroded banks. Farrington Ditch is not experiencing as much erosion as the other tributaries because it drains through four man-made detention basins which control the rate and volume of stormwater being discharged downstream.

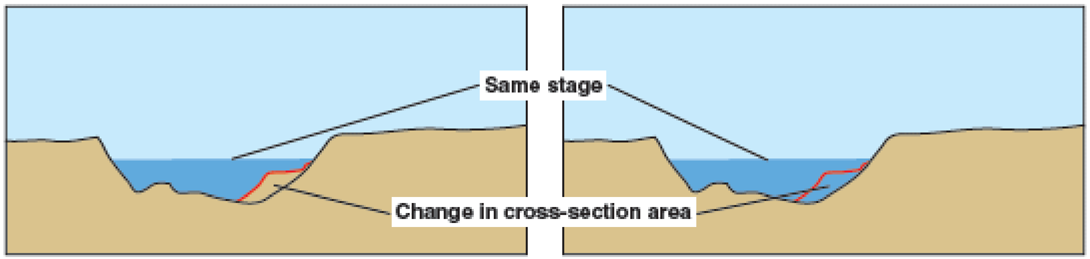


Figure 3-39: Diagram demonstrating a natural stream cross-section (left) and the altered cross-section of the same stream following erosion (right). Source: USGS.

Slight - Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.

Moderate - Bank is predominantly bare with some rills and vegetative overhang.

Severe - Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.

Table 3-26: 2013 Stream Inventory – Number of Stream Reaches with Streambank Erosion in the Buffalo Creek Watershed.

	North Branch		South Branch		Buffalo Creek Mainstem		Tributary A		Farrington Ditch	
Extent of Erosion	Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank	Left Bank	Right Bank
None	0	0	2	2	1	2	1	1	3	3
Slight	0	0	0	0	0	0	0	0	0	0
Moderate	5	4	10	10	16	14	8	8	2	2
Severe	2	3	1	1	7	8	1	1	0	0

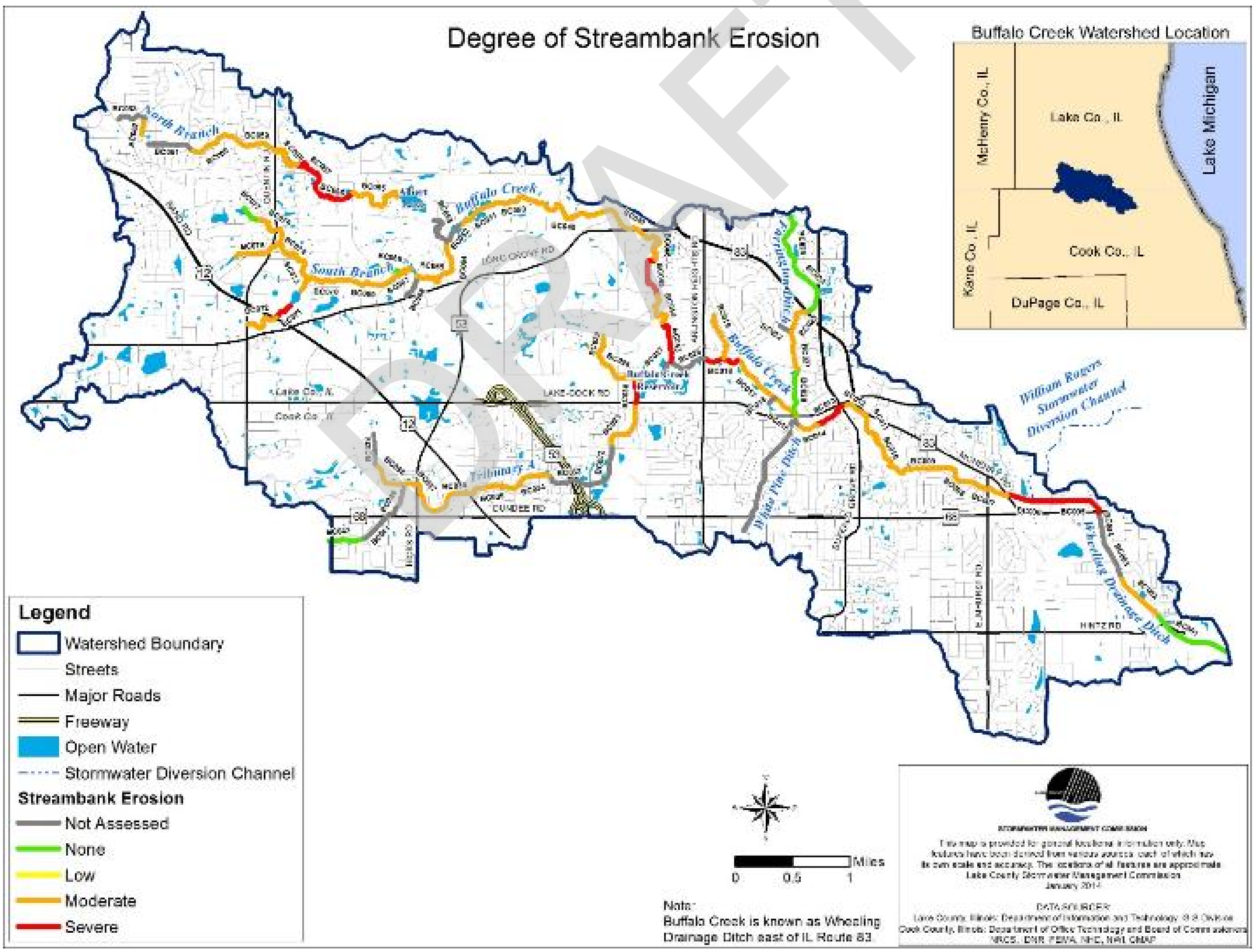


Figure 3-40: Degree of Streambank Erosion in the Buffalo Creek Watershed.

3.12.2.6 Sediment Accumulation

As mentioned in the previous section, sediment transport is a natural process occurring in all streams, but the magnitude can be affected by human modifications to the watershed. Typically, streams suspend and transport sediment through high-gradient (steep) reaches and deposit sediment in low-gradient (flat) reaches or areas where velocity slows. These may be naturally occurring flat sections of the stream (such as areas where the stream enters a wetland complex), areas behind beaver dams or debris jams, or areas upstream of human impediments such as culverts or dams.

Most reaches in the watershed have low or moderate sediment accumulation; see Table 3-27. Minimal sedimentation was observed in Farrington Ditch. High sedimentation was noted in the North and South Branches of Buffalo Creek and mainstem of Buffalo Creek, which is likely the result of the severe streambank erosion in these areas (see Figure 3-40).

Table 3-27: 2013 Buffalo Creek Watershed Stream Inventory - Sediment Accumulation.

Sediment Accumulation	North Branch		South Branch		Buffalo Creek Mainstem		Tributary A		Farrington Ditch	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%	Reaches	%
None (<5% of reach)	3	37%	2	7%	2	12%	0	0%	3	64%
Low (5-33%)	1	13%	4	37%	6	24%	7	67%	1	20%
Moderate (34-66%)	0	0%	2	19%	13	46%	2	24%	0	0%
High (67-100%)	3	50%	4	30%	3	18%	1	10%	0	0%
Unknown	0	0%	1	6%	0	0%	0	0%	1	16%
Total	7	100%	13	100%	24	100%	10	100%	5	100%

3.12.2.7 Debris Loading

In addition to sediment, most streams transport some amount of debris (organic material typically originating outside the stream itself, such as tree limbs, brush, and leaves). Because debris transport is a naturally-occurring stream process, some debris can provide habitat and contribute to a diverse in-stream environment. However, too much debris can be problematic and may result in large debris jams, causing backwater flooding and sediment deposition. Debris jams can also cause erosion of the streambanks which can lead to damage of riparian lands and property. It is not uncommon for streams that have a high degree of streambank erosion to also have high debris loads as trees along the stream banks are undercut by erosion and fall into the stream channel.

Photo of a stream reach that fails the debris load test in the Buffalo Creek Watershed, courtesy of SMC.

In the Buffalo Creek Watershed, reaches having a moderate or high debris load are considered to have the potential to be problematic. In some cases, these reaches may be in natural or open space areas and no action is needed or warranted. In other cases, moderate or high debris loads may be problematic and, for example, debris jams may warrant removal. Table 3-28 summarizes the reaches that “failed” the debris load test, having moderate or high in-stream and/or overbank debris loads. These reaches exhibit multiple debris jams, beaver dams, or overhanging debris obstructions extending across all or significant portions of the channel and/or onto the banks. In the Buffalo Creek watershed, 49 of the 59 assessed reaches failed the debris load test. The large number of stream reaches that failed the debris loading test are likely contributing to many of the flooding and streambank erosion issues plaguing the Buffalo Creek Watershed.

Table 3-28: 2013 Buffalo Creek Watershed Stream Inventory - Debris Loading.

Moderate or High Debris Load	North Branch		South Branch		Buffalo Creek Mainstem		Tributary A		Farrington Ditch	
	Reaches	%	Reaches	%	Reaches	%	Reaches	%	Reaches	%
Instream	4	55%	6	44%	10	42%	5	52%	2	42%
Overbank	4	55%	4	26%	8	38%	4	39%	2	42%

3.12.2.8 Hydraulic Structures

Photo of culverts in the Buffalo Creek Watershed, courtesy of SMC.

Hydraulic structures are bridges, culverts, dams, weirs, or other structures spanning or crossing the stream channel. These structures modify or have the potential to modify the pattern or amount of flow in the creek and may act as constriction points under certain flow conditions (such as floods), leading to backwater flooding. Additionally, dams and weirs can impede the movement of fish and other aquatic organisms within the stream network. Culverts may create temporary or permanent barriers if scour causes the bottom of the culvert to become elevated above the water level of the stream. Problem hydraulic structures include any obstructed bridges and culverts, culverts that are undermined or collapsed, bridges, culverts, dams and weirs that have been washed out, and beaver dams that are causing severe bank erosion or impounding a significant volume of water or length of stream channel. Structures are listed as “problem” structures to call attention to the need for further investigation, but this designation is not a definitive determination that the structure is defective.

Table 3-29 contains a summary of hydraulic structures in the Buffalo Creek Watershed. Locations of problem hydraulic structures are shown in Figure 3-41. The most common hydraulic structures in the Buffalo Creek Watershed are bridges, culverts and pipes which account for 87% of the hydraulic structures in the watershed. The Buffalo Creek mainsetm contains the largest number of hydraulic structures (see Table 3-29). Only 13 of the 201 structures (8%) identified in the inventory were identified as Problem Hydraulic Structures; of these the most common problem noted in the inventory was stream flow impairments.

Table 3-29: 2013 Buffalo Creek Watershed Stream Inventory - Hydraulic Structures.

Hydraulic Structures	North Branch	South Branch	Buffalo Creek Mainstem	Tributary A	Farrington Ditch
Bridge	8	13	34	23	9
Culvert	6	11	3	16	2
Dam	3	5	3	1	1
Pipe	10	17	6	3	13
Other	0	3	7	3	1
Total Hydraulic Structures	27	49	53	46	26
Hydraulic Structures per stream mile	9	12	5	12	12
Problem Hydraulic Structures	1	7	3	2	0

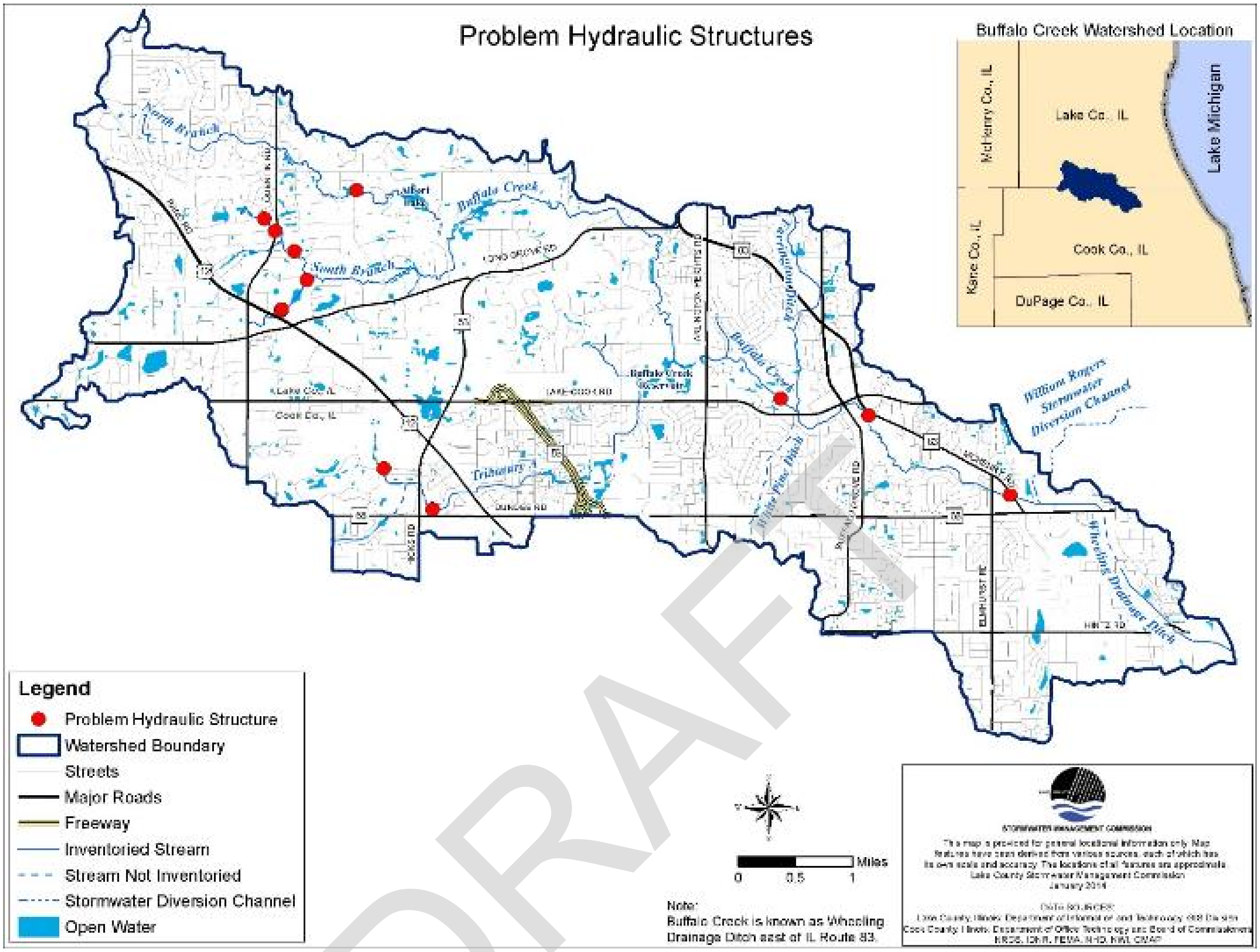


Figure 3-37: 2013 Buffalo Creek Watershed Stream Inventory - Problem Hydraulic Structures.

3.12.2.9 Discharge Points

Discharge points are identified as any outfalls into streams, and include "pipes" such as drain tile outlets, sump pump discharges, and storm sewers as well as "open channel" discharges such as drainage swales, ***gullies***, and small tributaries. The stream inventory documented 283 discharge points into the stream network within the assessed reaches. The mainstem of Buffalo Creek contains the majority (50%) of the documented discharge points. Most of these discharge points in Buffalo Creek are storm sewer pipes, culverts, and drain tiles. Mainstem Buffalo Creek also contains the majority (78%) of problem discharge points in the Buffalo Creek Watershed. Tributary A and the South Branch of Buffalo Creek combined account for 22% of discharge points in the Buffalo Creek Watershed. There are no problem discharge points in the North Branch of Buffalo Creek or Farrington Ditch.

> ***Gully:*** *A small valley or ravine originally worn away by running water and serving as a drainageway after prolonged heavy rains.*

Problem discharge points in the Buffalo Creek Watershed contribute to streambank erosion and the transport of excess sediment and associated nutrients to the stream channel. The location of these points is shown in Figure 3-42 and summarized in Tables 3-30 Pipes commonly cause erosion below the end of the pipe, resulting in a positive feedback loop of bank erosion near the pipe, and may ultimately result in the failure of the pipe itself. End sections, aprons, and supporting structures sometimes fail as a result of this type of erosion. Gullies and other open channels can also result in bank erosion, as they deliver concentrated flow to the stream channel. In some cases, pipes appear to be in poor repair, or flow may be discolored or appear to contain substances other than water. These cases are noted in the inventory as well.

Table 3-30: 2013 Buffalo Creek Watershed Stream Inventory - Discharge Points.

Discharge Points	North Branch	South Branch	Buffalo Creek Mainstem	Tributary A	Farrington Ditch
Swales, gullies, and tributaries	9	25	23	7	0
Pipes including storm sewers, culverts and drain tiles	24	30	119	35	11
Total Discharge points	33	55	142	42	11
Discharge points per stream mile	11	13	14	11	5
Problem discharge points	0	2	40	9	0

Photo of a drainage tile in the Buffalo Creek Watershed, courtesy of SMC.

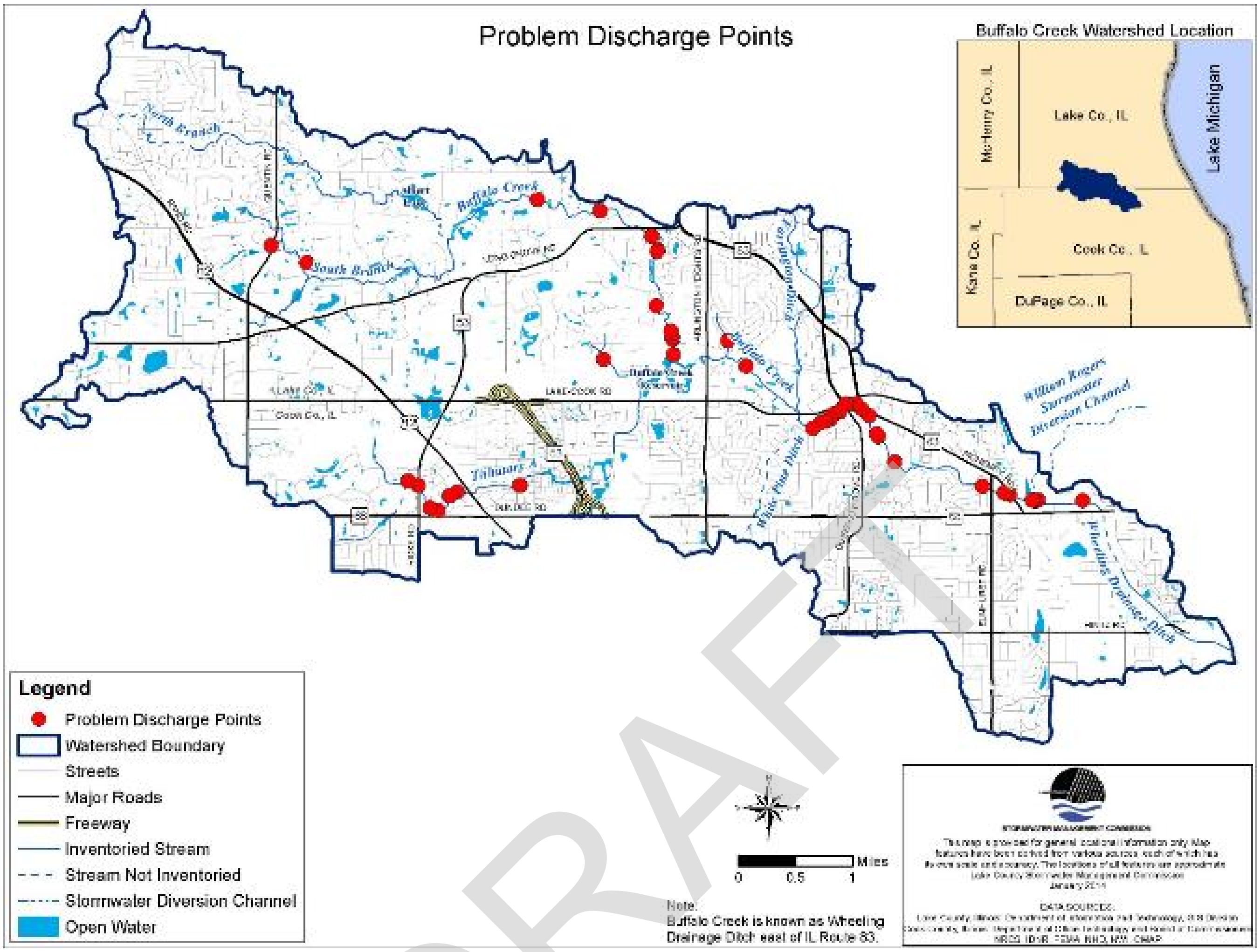


Figure 3-42: 2013 Buffalo Creek Watershed Stream Inventory - Problem Discharge Points.

3.12.2.10 Riparian Buffers

The width and quality of vegetated ***riparian buffers*** were visually assessed while walking the stream channel throughout the inventory and checked with aerial photography of the watershed. Vegetated riparian buffers are of interest because riparian vegetation can make streambanks more resistant to erosion, buffers act as filters for runoff and pollutants, and riparian areas offer habitat for wildlife and can be important links in the watershed ***green infrastructure network***. Using this combination of methods, the width of the vegetated riparian buffer was assessed for each reach, including several reaches that were not otherwise assessed in the inventory. Table 3-31 summarizes the assessment criteria for buffer width, while Table 3-32 displays the observed vegetated riparian buffer quality in 2013. Figure 3-43 displays the spatial distribution of riparian buffers in the watershed. Throughout the watershed, riparian buffer width is related to riparian land use. Typically, wide riparian buffers ("High" buffer width) are found in locations where the stream flows through open space areas, and narrow buffers ("Low" buffer width) are found in locations where the stream flows through developed areas.

Riparian Buffer: *A vegetated area near a stream, usually forested, which helps shade and partially protect a stream from the impact of adjacent land uses.*

Green Infrastructure Network: *Uses vegetation, soils, and natural processes to manage water and create healthier urban environments.*

Photo of a stream in the Buffalo Creek Watershed with adequate natural riparian vegetation (right) and turf grass with no natural riparian vegetation (left). Courtesy of SMC.

The mainstem of Buffalo Creek has more stream miles with no stream buffer or low stream buffer than any other stream in the Buffalo Creek Watershed. However, the mainstem of Buffalo Creek has one of the greatest numbers of stream miles with moderate or high stream buffers, second to Farrington Ditch. There are smaller streams with a greater percentage of stream miles with no or low stream buffers than the Buffalo Creek mainsetm, including the North and South Branches of Buffalo Creek, Tributary A and Farrington Ditch.

Table 3-31: 2013 Buffalo Creek Watershed Stream Inventory - Riparian Buffer Width Assessment Criteria.

Buffer Width Rating	None	Low	Moderate	High
Description	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.	Width of riparian zone 20-40 feet; human activities have impacted zone a great deal.	Width of riparian zone 40-60 feet; human activities impacted zone minimally.	Width of riparian zone >60 feet; human activities (parking lots, roadbeds, lawns, crops) have not impacted zone.

Table 3-32: 2013 Buffalo Creek Watershed Stream Inventory – Percentage of Stream Reaches and Stream Miles in Each Buffer Width Category.

Buffer Width Category	North Branch Left Bank		North Branch Right Bank		South Branch Left Bank		South Branch Right Bank		Buffalo Creek Mainstem Left Bank		Buffalo Creek Mainstem Right Bank	
	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles
Poor	71.14	2.12	71.14	2.12	61.47	2.60	65.48	2.77	58.69	5.84	53.67	5.34
Fair	28.86	0.86	28.86	0.86	28.37	1.20	24.35	1.03	32.46	3.23	38.49	3.83
Good	0.00	0.00	0.00	0.00	10.17	0.43	10.17	0.43	8.84	0.88	7.84%	0.78
TOTALS	100%	2.98	100%	2.98	100%	4.23	100%	4.23	100%	9.95	100%	9.95

Buffer Width Category	Tributary A Left Bank		Tributary A Right Bank		Farrington Ditch Left Bank		Farrington Ditch Right Bank	
	%	Miles	%	Miles	%	Miles	%	Miles
Poor	36.52	1.45	46.60	1.85	83.25	1.74	100	2.09
Fair	53.40	2.12	43.32	1.72	16.75	0.35	0.00	0.00
Good	10.08	0.40	10.08	0.40	0.00	0.00	0.00	0.00
TOTALS	100%	3.97	100%	3.97	100%	2.09	100%	2.09

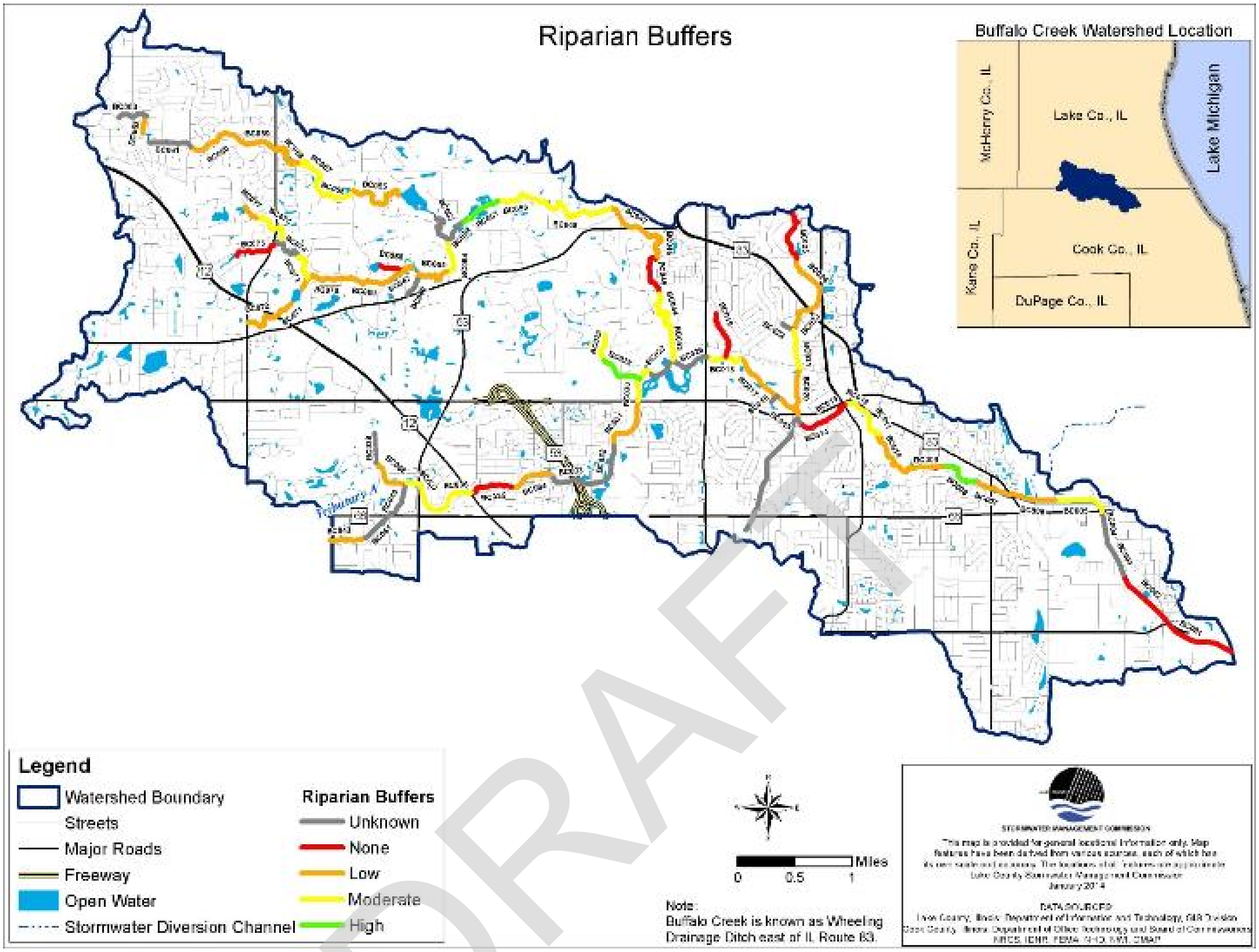


Figure 3-43: 2013 Buffalo Creek Watershed Stream Inventory – Riparian Buffers.

Noteworthy: Riparian Buffers & Impervious Cover

Large amounts of impervious cover such as driveways, roads, parking lots, rooftops, and sidewalks cannot efficiently absorb rainfall. This reduced infiltration increases runoff and peak flows. However, riparian buffers can mitigate some of the negative effects caused by impervious cover. Riparian buffers can slow surface runoff, thereby maintaining stable streambanks and reducing peak flows. Sediment, nitrogen, phosphorus and other pollutants common to urban runoff can be effectively filtered by riparian vegetation.

3.13 Detention Basin Inventory

Detention Basin: *An excavated area installed to collect runoff that is discharged to streams, wetlands or lakes to protect against flooding and, in some cases, downstream erosion by storing water for a limited period of a time.*

In 2013, SMC conducted a ***detention basin*** inventory on all detention basins in the watershed. Detention basins are man-made areas that are used to temporarily store stormwater runoff. Detention basins can be either dry or contain a permanent pool of water. The primary role of a detention basin is to control the quantity of water to prevent flooding, but the quality of stormwater runoff that enters local waterways is not addressed. Detention basins are constructed to capture stormwater from rain events and snowmelts, and then slowly release this water to a receiving stream or stormwater channel. This action reduces and delays peak flows downstream. Problems such as streambank erosion and water pollution are just a few of the consequences of poorly managed stormwater. Degraded streams and waterways can be restored by employing Best Management Practices (BMPs), such as retrofitting detention basins.

Detention basin retrofits include replacing turf grass, concrete channels and other impervious surfaces with native vegetation to maximize stormwater infiltration into the ground and increase evaporation and evapotranspiration. A number of vegetation types can be appropriate replacements for high-maintenance turf grass. These include native grasses, wildflower mixes or other herbaceous vegetation planted in the bottom or on the slopes of the basin. Additional benefits of retrofitting a detention basin include:

- Enhance and naturalize the landscape and improve native habitat.
- Prevent stream degradation and restore stream water quality.
- More effectively control runoff from small more frequent storms.
- Protect streams from polluted runoff, since basins that manage small storms more effectively capture and treat the "first flush" of non-point source pollutants found in surface runoff.
- Replenish groundwater and recharge aquifers.
- Reduce facility maintenance requirements.

Native vegetation can improve the infiltration of water back into the ground as well as remove pollutants from the stormwater runoff. Furthermore, native vegetation reduces mowing frequency to once or twice per year. Finally, this vegetation provides habitat for desirable wildlife species and provides ecological benefits.

Example of a detention basin retrofit. Source: Fairfax County Soil & Water Conservation District.

An inventory of the detention basins within the watershed provides valuable information that can be used to identify opportunities for existing detention basin water quality improvements. A total of 286 ponds were identified as potential detention basins using aerial image analysis, and 246 were subsequently field verified to insure that these areas were man-made detention basins. The location for each detention basin is illustrated in Figure 3-44. Forty detention basins are labeled as “Not Assessed” on Figure 3-44 because the field crews were unable to gain access to the basins during the inventory and were therefore not assessed. There are approximately 350 acres of detention basins in the watershed.

During the field verification process each basin was reviewed for the following information:

- Location (latitude/longitude)
- Size and drainage characteristics
- Design features
- Maintenance and design problems
- Potential safety problems
- Retrofit opportunities

The results of the inventory indicate that 238 of the 246 (97%) of the detentions basins would benefit from some type of improvement. Of those detention basins that could be improved, 58% are located in Lake County and 42% are located in Cook County. The addition of aerators and the removal of woody vegetation, accumulated sediment and other debris would also contribute to improving the overall water quality function of these detention basins.

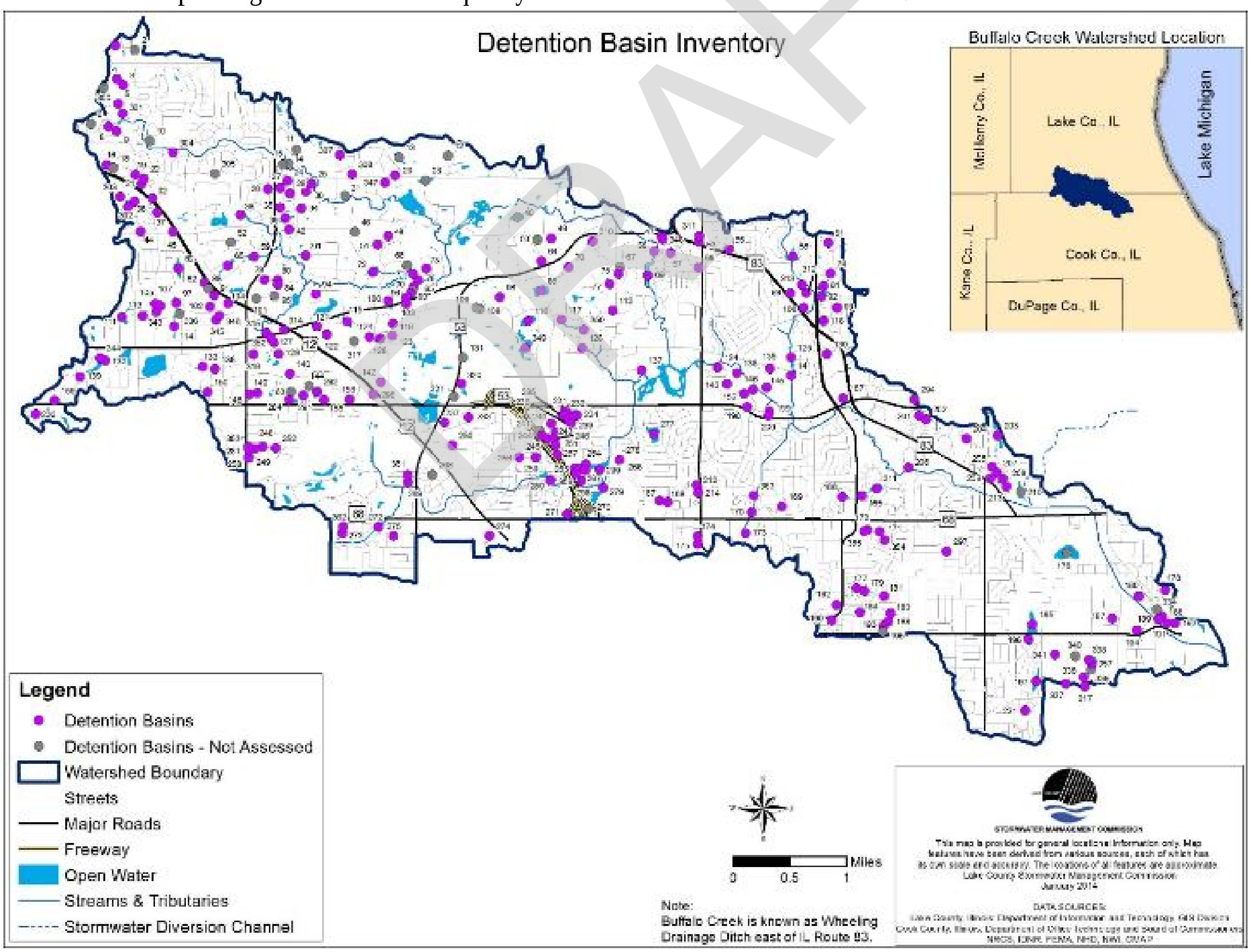


Figure 3-44: Detention Basin Inventory for the Buffalo Creek Watershed.

3.14 Watershed Lakes

The Buffalo Creek Watershed includes more than 566 acres of open water. Open water includes all lakes, ponds, streams, and wetlands with open water surfaces. Initially, there appeared to be 5 lakes greater than 10 acres within the watershed. After further investigation, 3 of the lakes greater than 10 acres within the watershed were determined to be wetlands and not considered a lake (see Table 3-33). Two of the lakes greater than 10 acres within the watershed, Buffalo Creek Reservoir and Albert Lake, were identified as impaired by the Illinois EPA in the Illinois 2008 Integrated Report (303(d) and Waterbody Assessment) Information for Des Plaines/Higgins Creek Watershed. Both lakes are impaired for total phosphorus and dissolved oxygen. Two additional lakes in the watershed, Bishop Lake and Lucy Lake, were also identified as impaired by the Illinois EPA. While these two lakes are under the 10 acre threshold, they are included in this section due to the designated impairment. Further discussion of these impairments is discussed in Chapter 5. Table 3-33 provides information on the assessment status of lakes greater than 10 acres within the watershed and the two additional impaired lakes smaller than 10 acres. Four of these lakes have been monitored by the Lake County Health Department – Ecological Services (LCHD-ES) (see Figure 3-45). The Buffalo Creek Reservoir and Albert Lake were assessed in 2013 by LCHD-ES. Copies of detailed lake reports, including historical data on all lakes in Lake County, can be obtained from http://health.lakecountyil.gov/Population/LMU/Pages/Lake-Reports.aspx.

Table 3-33: Lakes in the Buffalo Creek Watershed Greater than 10 Acres

Name	Acres	Assessment Status/ Comments
Deerpath Lake (mostly Cook)	16.5	Open water with wetland fringe
Buffalo Creek Reservoir	31.4	Assessed by LCHD-ES in 2013
Dover Pond	19.3	ADID Wetland 182
Mardan Oaks Lake/ Pond	22.5	Wetland
Albert Lake	17.8	Assessed by LCHD-ES in 2013
Bishop Lake	7.1	Assessed by LCHD-ES in 2004
Lucy Lake	8.2	Assessed by LCHD-ES in 2004

Threats to lakes can be described as coming from both external and internal sources. External sources include pollutants and nutrients draining into the lake from the watershed, such as stormwater runoff, fertilizers, and erosion. Once in the lake, many of these pollutants and nutrients stay in the lake for long periods of time. Internal processes in the lake then recycle many of the pollutants, particularly nutrients such as nitrogen and phosphorus. Plants and algae take up the nutrients, but once they die and decompose, the nutrients are recycled back into the system. In addition, if a lake exhibits anoxic conditions (less than 1 mg/L dissolved oxygen) at the bottom of the lake, additional processes take place that make additional nutrients and metals available in the water column. Thus, lake management must consider both the external and internal issues.

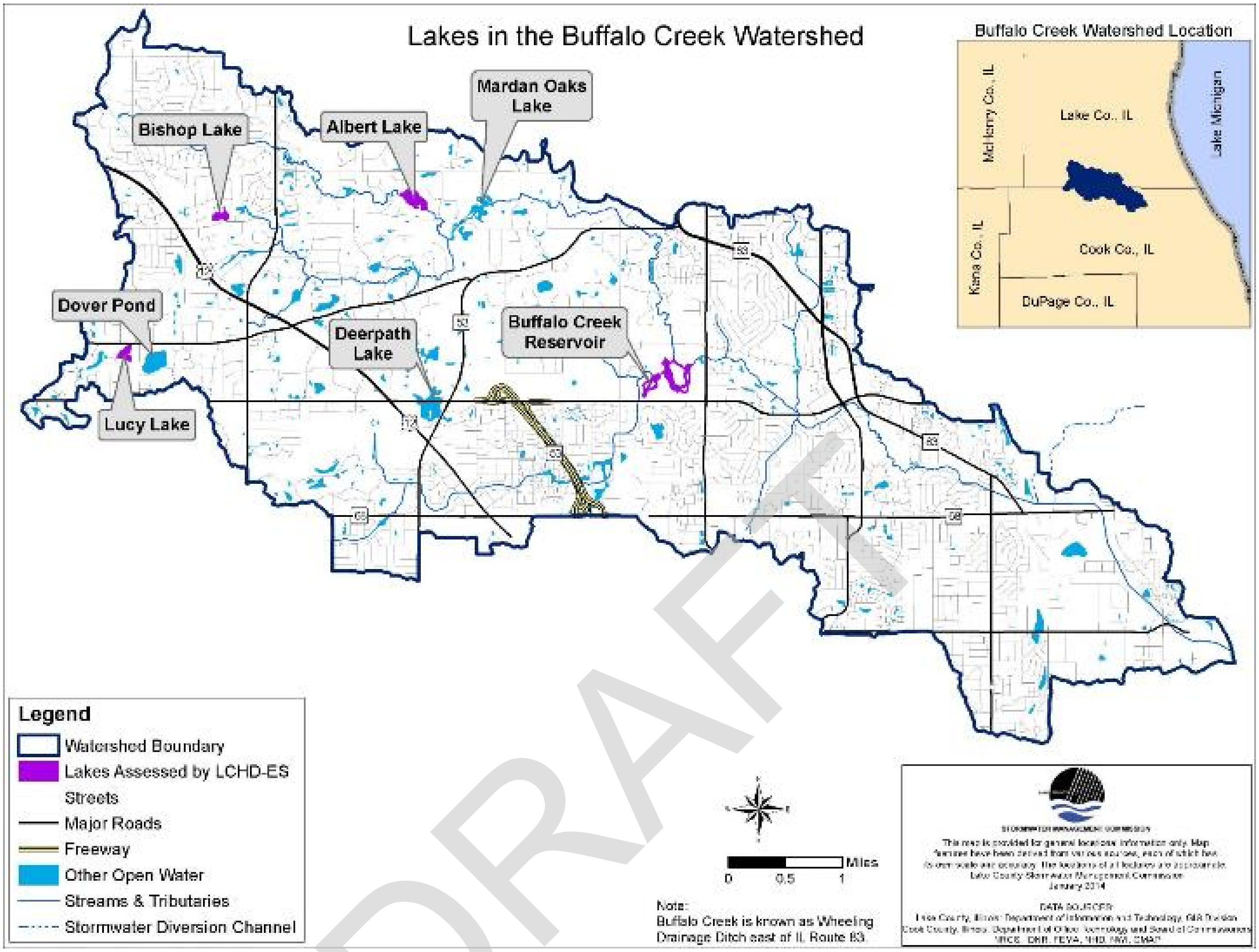


Figure 3-45: Lakes in the Buffalo Creek Watershed.

3.14.1 Individual Lake Summaries

3.14.1.1 Albert Lake

Photo of Albert Lake, courtesy of J. Weiss.

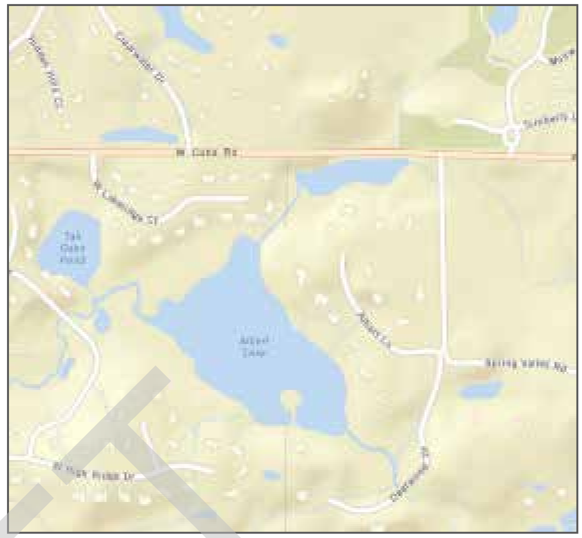


Figure 3-46: Location Map for Albert Lake.

Albert Lake is located in Ela Township and is partially in the Villages of Long Grove and Kildeer (Figure 3-46). The lake was created in the 1950's when a rock dam was constructed and flooded the surrounding area forming a shallow 18.7 acre lake. This dam failed and was replaced with the current dam by Hawthorne Developers. Albert Lake has a mean depth of 1.0 foot and maximum depth of 4.0 feet. The shoreline of the lake is approximately one mile long and dominated by a mix of wetland and woodland plant species. The lake's main use appears to be aesthetics since the shallow morphology of the lake prevents recreational use activities such as boating, fishing and swimming. No gas motors are permitted on the lake.

Albert Lake is on-line with Buffalo Creek and it receives water from a pond from the Tall Oaks Subdivision. Buffalo Creek winds through mostly residential areas before it enters Albert Lake from the west side of the lake. The water flows out of Albert Lake and into Buffalo Creek, eventually flowing into the Buffalo Creek Reservoir and then into the Des Plaines River.

Albert Lake Facts

Major Watershed: Des Plaines
Sub-Watershed: Buffalo Creek
Location: T 43N, R 10-10E, S 26
Surface Area: 18.7 acres
Shoreline Length: 0.982 miles
Maximum Depth: 4 feet
Average Depth: 1 foot
Lake Volume: 18.7 acre feet
Watershed Area: 1812 acres
Lake Type: Man-made impoundment.
Management Entity: Deerwood Estates HOA
Current Uses: Aesthetics
Access: Private

Photos of Albert Lake courtesy of Lake County Health Department – Environmental Services

3.14.1.2 Buffalo Creek Reservoir

Photo of Great Blue Heron and Great White Egret at the Buffalo Creek Reservoir. Photo courtesy of Lake County Health Department.

Figure 3-47: Location Map for the Buffalo Creek Reservoir.

The 35.18 acre Buffalo Creek Reservoir is located within the 408 acre Buffalo Creek Forest Preserve property in unincorporated Lake County, Illinois (Figure 3-47). The Lake County Forest Preserve District (LCFPD) acquired the property between 1978 and 1987. The reservoir was constructed in 1984 as part of a joint effort between LCFPD and the MWRD to store stormwater from the Buffalo Creek Watershed. It was later expanded in 1989. The reservoir was “carefully designed to create a natural looking wetland area” (LCFPD). Flora and fauna are found in the area and it is common to see great blue heron and egret along the shorelines of the basins.

The reservoir contains two basins that are separated by a gabion weir. BCR1 is the basin on the west side, and receives water from a small part of the Buffalo Creek watershed located in Lake County plus the Tributary A drainage area in Cook County. BCR2 is located to the east of BCR1

Buffalo Creek Reservoir Facts

Major Watershed: *Des Plaines*
Sub-Watershed: *Buffalo Creek*
Location: *T46N, R10E, Section 34*
Surface Area: *35.18 acres*
Shoreline Length: *2.98 miles (BCR1, 0.95 miles; BCR2, 2.03 miles)*
Maximum Depth: *BCR1, 3.91 feet; BCR2, 4.92 feet*
Average Depth: *3.00 feet*
Lake Volume: *BCR1, 125.84 acre-feet; BCR2, 186.03 acre-feet*
Maximum storage capacity: *Approx. 700 acre-feet*
Watershed Area: *10,299.76 acres*
Lake Type: *Stormwater Impoundment*
Management Entity: *MWRD/Lake County Forest Preserve District*
Current Uses: *fishing, aesthetics, storm water retention*
Access: *Public*

and receives water from BCR1 as well as the remaining drainage area of the North and South Branches of Buffalo Creek in Lake County. The maximum depth of the basins differs slightly, BCR1 is 3.91 feet deep and BCR2 is 4.92 feet deep.

The MWRD, in cooperation with LCFPD, is developing engineering design plans to expand MWRD's existing Buffalo Creek Reservoir and improve public access at the preserve. The concept plan (see Figure 3-48) will help guide stormwater storage, public access improvements and extensive natural resource restoration work at the 408-acre Preserve. The plan calls for an additional 30-acre regional stormwater storage flood control reservoir to be constructed and paid for by the MWRD. It will be designed to blend into and enhance the natural environment. In order to construct the reservoir, the MWRD needs to obtain a drainage easement over the middle portion of Buffalo Creek, just west of Schaeffer Road. The concept plan improvements for Buffalo Creek would be funded by the MWRD and are estimated to be in excess of $10.4 million.

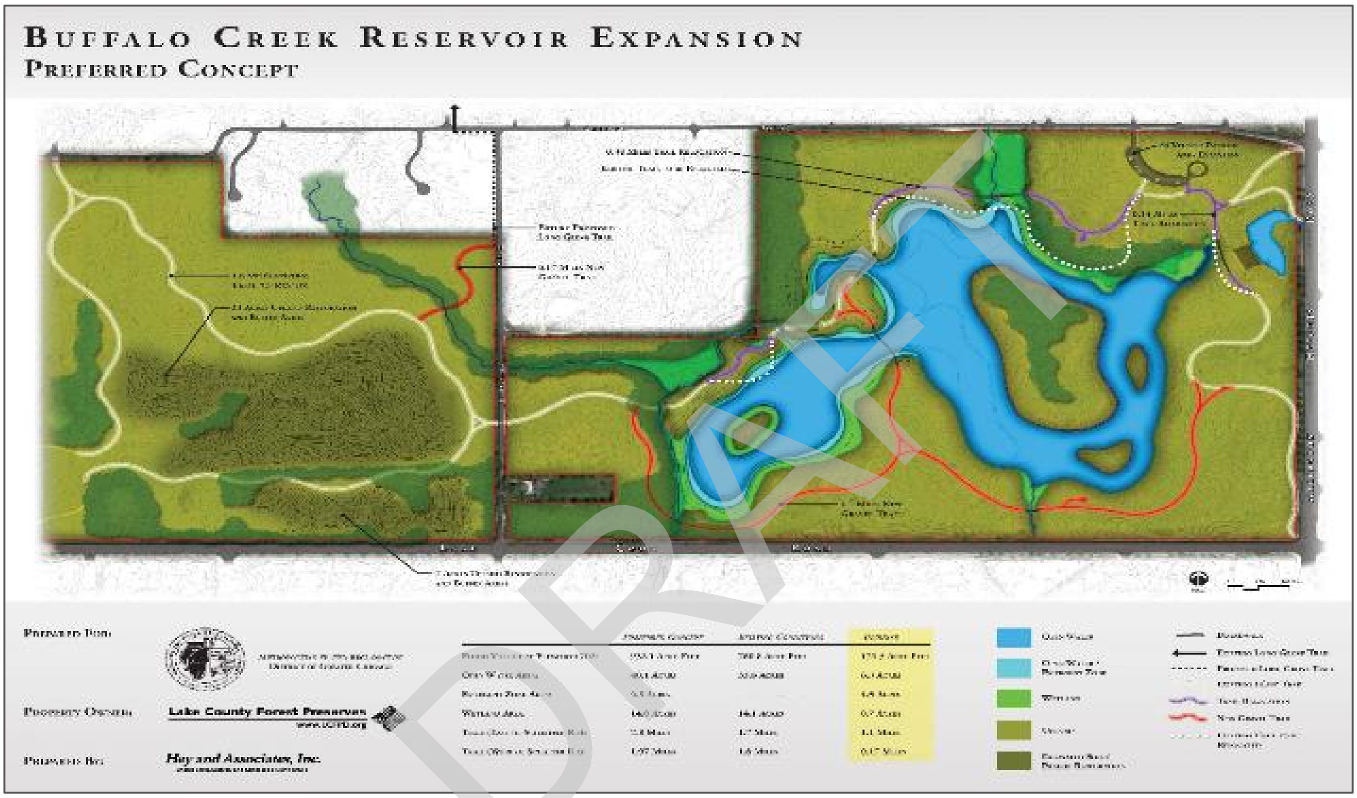


Figure 3-48: Buffalo Creek Reservoir Expansion Concept Plan. Figure taken from the Lake County Forest Preserve website: www.lcfpd.org.

3.14.1.3 Bishop Lake

Bishop Lake is privately owned, and located within the Village of Kildeer. The outlet of the lake is a dropbox culvert at the northeast part of the shoreline, which then drains east to Buffalo Creek. Bishop Lake is a manmade lake, created in approximately 1926. The lake has a surface area of 7.12 acres and a maximum depth of 12 feet. Development around the lake began in the early to mid-1980's, and in 1992, an informal association, the Bishop Lake Property Owner's Association (BLPOA), was formed. The association has implemented some lake management activities such as fish stocking and the installation of an aeration system. They also treat the lake with herbicides and algicides on an annual basis. Association members primarily use

Photo of Bishop Lake. Source: http://thelubygroup.com/listing/22216-w-cuba-road-kildeer-il-60047.

the lake for aesthetic purposes, but fishing and non-motorized boating are allowed. Some homes have private beaches for swimming. Use of the lake is limited to the homeowners and their guests. Approximately 80% of the shoreline is considered developed, with the majority typified as seawall. Other shoreline types are lawn, buffer and woodland (LCHD_ES, 2004).

3.14.1.4 Lucy Lake

Lucy Lake is located in the Village of Deer Park, with Charlie Brown Park bordering the lake on the west side. Water exits Lucy Lake via an unnamed tributary on the southeast end and flows into a wetland before eventually entering Buffalo Creek. The lake has a surface area of 8.2 acres and mean and maximum depths of 13.5 feet and 27 feet, respectively. However, these numbers are deceptive, as the morphometry of Lucy Lake is quite unique. Approximately half of the lake is about two feet deep, while the other half ranges from about five feet to 27 feet in depth. Considering the data collected on various depths throughout Lucy Lake, the average depth is probably closer to nine feet. Lucy Lake is managed by the Village of Deer Park, who also owns Charlie Brown Park. The lake is used by residents and park visitors for non-motorized boating, fishing and aesthetics (LCHD-ES, 2004).

Photo of Lucy Lake from Charlie Brown Park. Source: http://activerain.com/blogsview/1581818/welcome-to-deer-park-il-a-park-like-village-with-an-upscale-shopping-mall-and-good-schools.

3.14.2 Lake Inventory

The following sections describe the results of the lake inventory conducted in 2013 by Lake County Health Department Ecological Services division (LCHD-ES) for Lake Albert and the Buffalo Creek Reservoir. Lakes were assessed for shoreline erosion, aquatic plants, floristic quality, and water quality.

3.14.2.1 Shoreline Erosion

Limiting Nutrient: *The hardest nutrient for a plant to acquire and therefore the only nutrient that is limiting the plant's growth. Generally, phosphorus is a limiting nutrient in freshwater systems and nitrogen is a limiting nutrient in saltwater systems.*

As part of the lake inventory, shoreline erosion was assessed in Albert Lake and the Buffalo Creek Reservoir. Erosion is a natural process primarily caused by excessive runoff from rain or melting snow, and wave action, which results in the loss of material from the shoreline. Shorelines disturbed by human activity such as clearing of natural vegetation and beach rocks, and increasing runoff will accelerate erosion. Shoreline erosion contributes to poor water quality by increasing the amount of both total suspended solids and phosphorus concentrations in a lake, resulting in either: 1) a very productive lake due to an increase of the ***limiting nutrient*** (phosphorus) or 2) a lake with few aquatic plants due to decreased water clarity as either excessive amounts of sediment or algae are in the water column. In a system without plants, algae can become a problem due to the lack of competition for nutrients. Sedimentation can cause destruction of habitat for fish and other macroinvertebrates by reducing foraging and breeding sites or by direct suffocation of eggs. The results of the 2013 shoreline assessment are depicted in Table 3-34 and Figures 3-49 through 3-50.

Table 3-34: Comparative results of 2001 and 2013 Shoreline Erosion Assessment for Lakes in the Buffalo Creek Watershed.

	Albert Lake		Entire Buffalo Creek Reservoir		Buffalo Creek Reservoir 2013	
Erosion	2001	2013	2001	2013	BCR1	BCR2
None	37%	78%	95%	40%	52%	34%
Slight	54%	19%	0%	17%	21%	15%
Moderate	6%	3%	5%	26%	9%	34%
Severe	3%	0%	0%	17%	18%	17%
Total	100%	100%	100%	100%	100%	100%

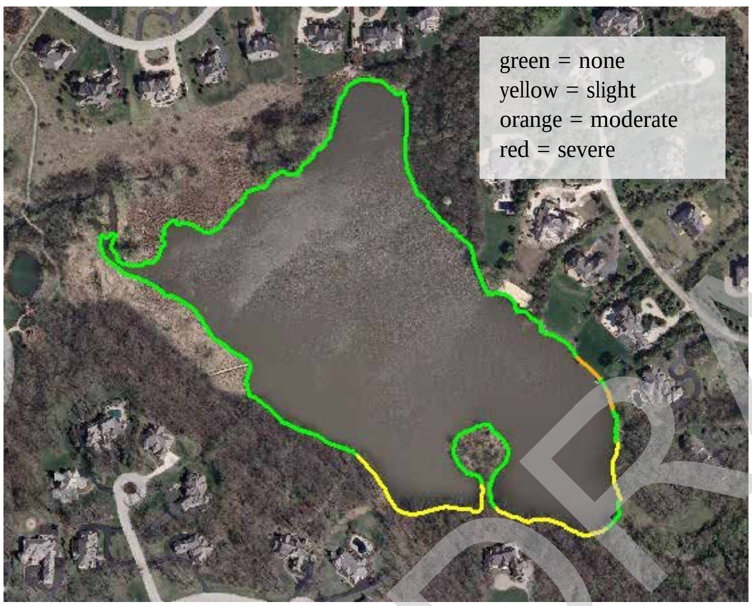


Figure 3-49: Shoreline erosion on Albert Lake, 2013.

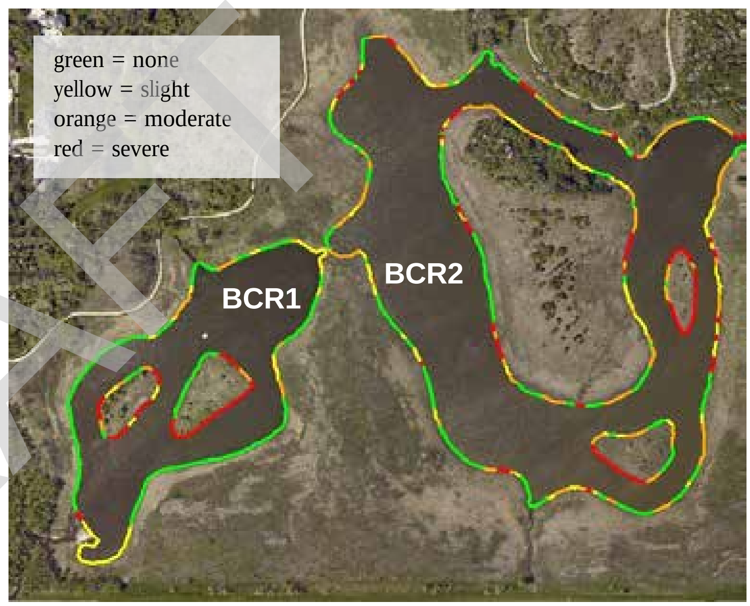


Figure 3-50: Shoreline Erosion on Buffalo Creek Reservoir, 2013.

Based on the shoreline erosion assessment conducted at Albert Lake on September 19, 2013 compared to a 2001 assessment, there was a significant decrease in shoreline erosion with approximately 78% of the shoreline having no erosion in 2013. In 2001, Albert Lake had only 37% of the shore with no erosion. Overall, 19% of the shoreline had slight erosion, 3% had moderate erosion, and 0% had severe erosion in 2013. A monitoring program should be established in order to identify problem areas and manage invasive plants in these areas.

In October of 2013, the shoreline of Buffalo Creek Reservoir was assessed for erosion. Sixty percent of the reservoir was exhibiting some degree of erosion. Forty-three percent of the erosion was either moderate (26%) or severe (17%). An additional 17% was assessed as having slight erosion. The amount of erosion in the basin decreased since its last assessment in 2001. At that time, 84% of the shoreline was assessed as having some degree of erosion; however, the severity of the erosion found on the shoreline has increased. It can be expected that the reservoir would experience larger fluctuations in water levels than a typical lake would experience because the reservoir is a constructed flood control facility designed to manage stormwater. This fluctuation in water level or “bounce” may influence the stability of the shorelines, and makes shoreline stabilization more challenging. There was also a difference in the percent of shoreline eroding between the basins. The western basin, BCR1, exhibited 44% of its shoreline with some degree of erosion while the eastern basin, BCR2, exhibited some degree of erosion on 66% of its shoreline. There were also differences in the degree of erosion between the basins, with the most notable difference being in the moderate classification. BCR1 had 9% of its shoreline showing signs of moderate erosion while 34% of BCR2 exhibited the same degree of erosion on its shorelines. This could be due to differences in elevation between the basins; as BCR1 is situated higher in the landscape than BCR2. LCHD-ES recommends that shoreline slopes be minimized and the construction of vegetated shelves be considered during the redesigning of the basins. If there are slopes not planned to be impacted by the expansion, consideration should be given to reducing those slopes also to minimize erosion. A mix of solutions can be implemented to remedy eroded areas ranging from vegetating areas with native plants so that their deep root systems can better anchor soils along shoreline areas to the use of hardscaping materials where native plant buffers will not provide enough stability due to fluctuating water levels.

Noteworthy: Shoreline Assessment

The degree of shoreline erosion was categorically defined as none, slight, moderate, or severe. Below are brief descriptions of each category.

None – No erosion evident. This may include areas of beach and effective rip rap, and sea wall stabilization practices.

Slight – Minimal or no observable erosion; generally considered stable; no erosion control practices will be recommended with the possible exception of small problem areas noted within an area otherwise designated as "slight".

Moderate – Recession is characterized by past or recently eroded banks; area may exhibit some exposed roots, fallen vegetation or minor slumping of soil material; erosion control practices may be recommended although the section is not deemed to warrant immediate remedial action.

Severe – Recession is characterized by eroding of exposed soil on nearly vertical bans, exposed roots, fallen vegetation, or extensive slumping of bank material, undercutting, washouts, or fence posts exhibiting realignment; erosion control practices are recommended and immediate remedial action may be warranted.

Shoreline erosion usually increases when deep-rooted native vegetation is replaced by shallow-rooted non-native vegetation such as turf grass. Erosion not only results in loss of shoreline, but also negatively influences the lake's overall water quality by contributing nutrients, sediment, and pollutants into the water. Additionally, turf grasses or constructed seawalls provide little habitat for wildlife and do not serve as a natural buffer to filter runoff. As suburban development increases in this area, it can be assumed that increased phosphorus loading and surface runoff will occur, resulting in increased algal blooms and decreased water quality (Novotny, 1995).

3.14.2.2 Floristic Quality Index (FQI)

Floristic Quality Index (FQI): *An assessment tool designed to evaluate how close the flora of an area is to that of undisturbed natural plant communities.*

Floristic quality, as measured by the ***Floristic Quality Index (FQI)***, is summarized in Table 3-35 for the two assessed lakes. The plant community in Albert Lake was assessed in September when most of the aquatic plants were likely to be present. Aquatic plant populations in Albert Lake have increased since 2001. In 2001, only 7% of the sampled areas had plants while 100% of the area sampled in 2013 had plants. The density of plants has also increased with 15 of the 22 sample sites having 40-90% coverage. Flatstem pondweed (*Potamogeton zosteriformis*) is a new addition that was not observed in the 2001 aquatic plant survey. In 2013, Albert Lake had an FQI of 11.5, ranking 95th out of 162 lakes in Lake County. The FQI score of Albert Lake is below the Lake County average because there are few native species and the invasive curlyleaf pondweed (*Potamogeton crispus*) is dominant. Aquatic vegetation in Buffalo Creek Reservoir was sampled throughout the reservoir during September 2013. In total, 34 sites were evaluated, 79% of which were vegetated. There were 6 plant species identified in the reservoir in 2013. Curlyleaf pondweed, a non-native, invasive species was among those identified. The diversity of plants in the reservoir has not changed since 2001; however, species composition has changed, and species such as leafy pondweed and small pondweed have since been replaced by duckweed and elodea, which are less conservative (high quality) species. The FQI of the reservoir dropped slightly from 13.1 in 2001 to 12.5 in 2013 (ranking 81st and 82nd among Lake County lakes for BCR1 and BCR2 respectively). This is most likely due to the presence of weedier species.

Table 3-35: 2013 Floristic Quality Index Assessment for Lakes in the Buffalo Creek Watershed.

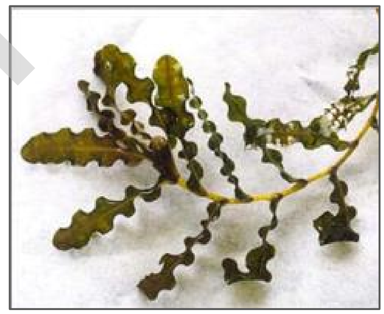
Lake	FQI	Lake County Average FQI	FQI County Ranking (out of 162)
Albert Lake	11.5	13.8	95
Buffalo Creek Reservoir (BCR-1 & BCR-2)	12.5	13.8	81 (BCR-1)/82 (BCR-2)

3.14.2.3 Aquatic Plants

Aquatic plants are a critical feature in most water bodies as they compete against algae for nutrients, improve water quality and provide fish habitat. Aquatic plant diversity is an important part of a healthy ecosystem. In 2013, LCHD-ES conducted an aquatic plant mapping survey of the two lakes. The survey provides information on the species, density, and distribution of plant communities in a given lake. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow. The LCHD-ES lake surveys results are shown in Table 3-36 and depicted on Figures 3-49 and 3-50.

Table 3-36: 2013 Aquatic Vegetation Density and Percentage of Native/Invasive Species for Lakes in the Buffalo Creek Watershed.

Lake	# of Points Assessed	% of Points Vegetated	# of Native Plant Species Found	# of Invasive Plant Species Found
Albert Lake	22	100%	4	1
Buffalo Creek Reservoir	34	79%	5	1



Curlyleaf pondweed (***Potamogeton crispus***). Photo courtesy of Northeast Michigan Watersheds.

Noteworthy: Floristic Quality Index

Floristic quality index (FQI; Swink and Wilhelm 1994) is an assessment tool designed to evaluate how close the flora of an area is to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term trends, and 4) monitor habitat restoration efforts. Each aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). This is done for every floating and submerged plant species found in a lake. These numbers are averaged and multiplied by the square root of the number of species present to calculate an FQI. A high FQI number indicates that there are a large number of sensitive, high quality plant species or a good diversity of plants present in a lake. Non-native species were counted in the FQI calculations for Lake County lakes. (LCHD-ES Reports).

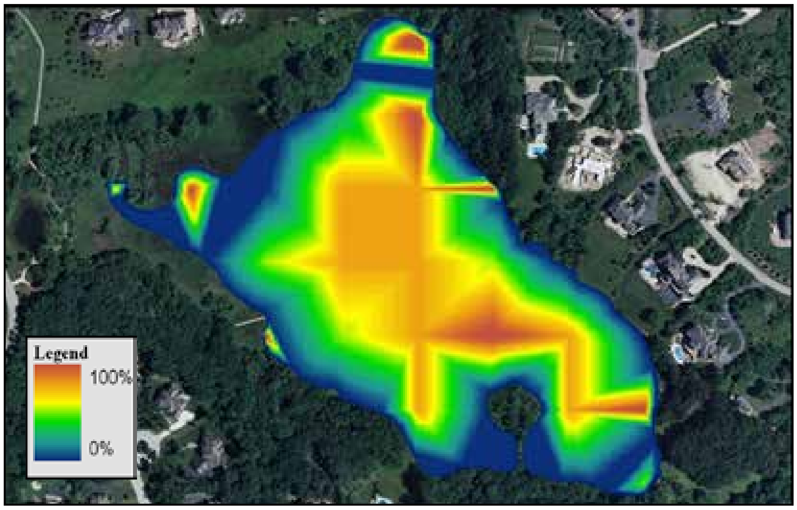


Figure 3-49: Aquatic Plant Density on Lake Albert in 2013.

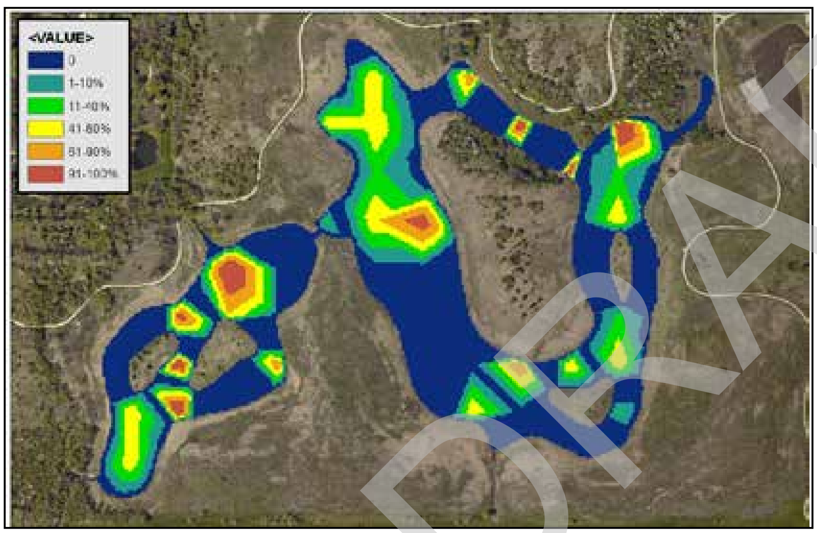


Figure 3-50: Aquatic Plant Density on Buffalo Creek Reservoir in 2013.

Noteworthy: Plant Sampling

In order to randomly sample each lake, mapping software (ArcMap 9.3) overlaid a grid pattern onto an aerial photo of Lake County and placed points 60 or 30 meters apart, depending on lake size. Plants were sampled using a garden rake fitted with hardware cloth. The hardware cloth surrounded the rake tines and is tapered two feet up the handle. A rope was tied to the end of the handle for retrieval. At designated sampling sites, the rake was tossed into the water, and using the attached rope, was dragged across the bottom, toward the boat. After pulling the rake into the boat, plant coverage was assessed for overall abundance. Then plants were individually identified and placed in categories based on coverage. Plants that were not found on the rake but were seen in the immediate vicinity of the boat at the time of sampling were also recorded.

3.14.2.4 Water Quality

Water quality parameters such as nutrients, suspended solids, oxygen, temperature and water clarity were measured from May-September 2013 in Albert Lake and the Buffalo Creek Reservoir.

Albert Lake: The average ***Total Kjeldahl nitrogen (TKN)*** concentration for Albert Lake outlet was 1.28 mg/L, which was higher than the county median of 1.170 mg/L and lower than the 2001 concentration by 46.3% (2.24 mg/L). A total nitrogen to total phosphorus (TN:TP) ratio of 22:1 indicates that phosphorus was the nutrient limiting aquatic plant and algae growth in Albert Lake. By using phosphorous as an indicator, the ***trophic state index (TSIp)*** ranked Albert Lake as ***hypereutrophic*** with a TSIp value of 93.7. This means that the lake has excessively high nutrients. Hypereutrophic lakes are often pea-soup green, with poor water clarity and are susceptible to winter fish kills. As a result, rough fish such as carp dominate Albert Lake. The 2013 average total suspended solids (TSS) concentration for Albert Lake was 10.01 mg/L, which was greater than the county median (8.0 mg/L).

Total Kjeldahl Nitrogen (TKN): *The sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4^+).*

Trophic State Index (TSIp): *Used to make a rough estimate of a water body's biological condition, it is a measure of the quantities of nitrogen, phosphorus, and other biologically useful nutrients.*

Hypereutrophic: *Very nutrient-rich water bodies characterized by frequent and severe nuisance algal blooms and low transparency.*

Albert Lake has a large watershed that contributes to the high concentrations of chloride in the lake primarily from road salts. The conductivity of Albert Lake outlet was 0.8974 mS/cm which is higher than the county median (0.7875 mS/cm). The chloride concentration in Albert Lake in 2013 was 137 mg/L which was lower than the county median of 145 mg/L. While there is typically a correlation between conductivity and chloride levels, it is not always the case. Chloride is just one ion in the water that can influence conductivity. In the Midwest it is typically the most influential, but there could be other ions in the water that caused the conductivity in this instance to be high.

Buffalo Creek Reservoir: Sampling was conducted at two locations in 2013 (see Figure3-51). The overall water quality of the reservoir is poor (LCHD 2013). Like many lakes in our region, it is impaired for phosphorus based upon the IEPA's standard for total phosphorus (TP) of $\geq$ 0.05 mg/L. The average TP concentrations found in the reservoir in 2013 were 0.068 mg/L and 0.096 mg/L, for BCR1 and BCR2, respectively. In 2013, the ratio of total nitrogen to total phosphorus (TN:TP) was 13:1 in BCR1 and 12:1 in BCR2. These rations indicate that there are plenty of both nutrients in the basins to promote nuisance algae or plant growth.

Figure 3-51: 2013 Water quality sampling locations in the Buffalo Creek Reservoir (left) and Albert Lake (right).

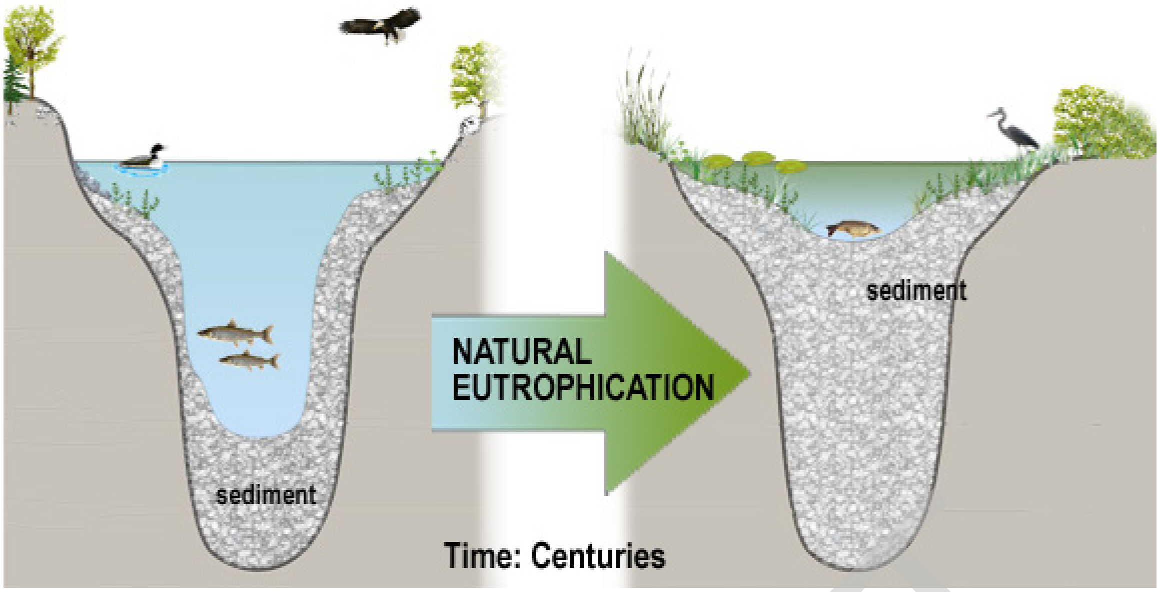


Figure 3-52: Image of the natural eutrophication process. Source: RMB Environmental.

The TSIp for BCR1 was 65 and 70 for BCR2. A higher TSIp score indicates a nutrient rich system. Based on the TSIp scores, BCR1 is eutrophic and BCR2 is hypereutrophic.

The average chloride concentration in 2013 was the same in both BCR1 and BCR2 - 210 mg/L; this is considered elevated and begins to approach the U.S. Environmental Protection Agency's (USEPA) critical concentration for chlorides of 230 mg/L. The average chloride concentration in BCR2 has decreased slightly based upon the estimated average chloride concentration of 217 mg/L from 2001.

Secchi Disk: *A Secchi disk is a black and white disk lowered by hand into the water to the depth at which it vanishes from sight. This depth is then recorded and is commonly used as a measure of water clarity.*

The average ***Secchi*** depths measured at BCR1 (2.6 feet) and BCR2 (2.3 feet) with a ***secchi disk*** were both below the county median (3.00 feet) for lakes sampled between 2000 and 2013. The average Secchi depth in BCR2 has improved since 2001when it was 1.1 feet. Secchi depth can be affected by differences in precipitation, carp population, or even the amount of construction activity taking place in the watershed during the periods monitored. Water clarity is directly related to phosphorus levels. The state of Illinois set the Secchi depth (water clarity) standard at 4 feet for swimming and 1.5 feet for general water quality. Figure 3-XX illustrates how the secchi disk is used to measure water clarity.

TSS concentrations in the Buffalo Creek Reservoir varied by basin. The average TSS concentration at BCR1 was 7.2 mg/L, and was below the county median of 8.0 mg/L for lakes in the county assessed between 2000 and 2013, while the average TSS concentration in BCR2 was 19.2 mg/L and is more than double the county median TSS concentration. The difference between the TSS levels in the two basins in most likely a result of carp in BCR2. BCR1 had more plants (BCR2 basically had no plants) and therefore less of a carp problem.

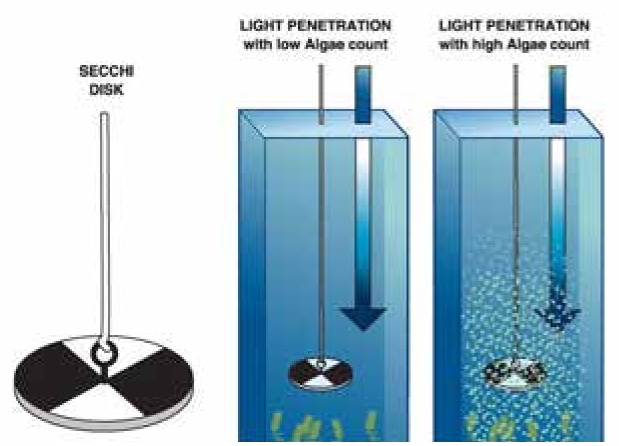


Figure 3-53: Graphic Representation of a secchi disk in use. Source: Fourteen Island and Mink Lake Association.

There is no record of a fish survey being completed by the Illinois DNR for the Buffalo Creek Reservoir. It is likely that there is at the very least a rough fish population present in the reservoir as there have been frequent observations of fishermen fishing from the shorelines. Table 3-37 below summarizes documented Secchi disk, phosphorus concentrations, nitrogen, chloride, TSS and TSIp for Lake Albert and the Buffalo Creek Reservoir.

Table 3-37: Water Quality Summary of the Lakes in the Buffalo Creek Watershed.

Lake	Secchi Depth (ft.)	Phosphorus (mg/l)	Nitrogen (TKN) (mg/l)	Chloride (mg/l)	TSS (mg/l)	TSIp Category
Albert Lake	N/A	0.495	1.28	137	10.01	Hypereutrophic
BCR 1	2.6	0.068	1.10	210	7.20	Eutrophic
BCR 2	2.3	0.096	1.18	210	19.20	Hypereutrophic

3.14.2.5 Lake Recommendations

Lake Albert's water quality has improved since 2001 with decreases in TP and TN, which means that there are fewer nutrients available for algae-blooms to occur. The TSS concentration also decreased since 2001. To improve the overall quality of Albert Lake, LCHD-ES has the following recommendations:

- Reduce or eliminate common carp.
- Mitigate shorelines exhibiting erosion.
- Encourage homeowners to incorporate native plants in their landscaping through rain gardens or shoreline filter strips.
- Create a curlyleaf pondweed management plan in order to allow native plants to establish in the spring.
- Participation in the Volunteer Lake Monitoring Program.
- Install a staff gauge to monitor lake level fluctuations.
- Assess current fish population.
- Help reduce chlorides by supporting wise use of road salt in the watershed.

Common Carp (*Cyprinus carpio*). Photo courtesy of NSW Department of Primary Industries.

LCHD-ES recommends the following actions for improving the water quality and overall health of Buffalo Creek Reservoir:

- Reduce or eliminate common carp.
- Promote the spread of native vegetation in basins. Management of curlyleaf pondweed early in spring before natives emerge would allow for spread of native species.
- Work with homeowner groups in Buffalo Creek Watershed to identify problems with eroding shorelines, and non-point sources of pollutants such as chlorides and phosphorus.
- Remediate eroded shorelines within the basin and throughout watershed to minimize sediments from entering into the lake. There are many options available to secure shorelines, naturalizing the shoreline with native plants provides a buffer for nutrient inputs as well as an attractive viewscape, in areas where this is not feasible a combination of hardscaping and shoreline naturalization should be considered.
- If the goal is to support fish in the reservoir, it is recommended that the depth of the basins be increased.

- Consider water quality as well as fish and wildlife habitat in any proposed expansion of the system.

Noteworthy: Trohpic State Index

Another way to look at phosphorus levels and how they affect lake productivity is to use a Trophic State Index (TSI) based on phosphorus (TSIp). TSIp values are commonly used to classify and compare lake productivity levels (trophic state). Eutrophication is a natural process where lakes become increasingly enriched with nutrients. A lake's response to additional phosphorus is an accelerated rate of eutrophication. Lakes start out with clear water and few aquatic plants and over time become more enriched with nutrients and vegetation until the lake becomes a wetland. This process takes thousands of years to take place. However, human activities that supply lakes with additional phosphorus that drives Eutrophication is speeding up this process significantly. The TSIp index classifies the lake into one of four categories: oligotrophic (nutrient poor, biologically unproductive), mesotrophic (intermediate nutrient availability and biological productivity), and eutrophic (nutrient rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). In 2013, Albert Lake was eutrophic with TSIp Value of 93.7, placing it 172th out of 175 lakes in the county.

3.15 Lake and Stream Water Quality Monitoring

Multiple agencies and groups have collected water quality data in the Buffalo Creek Watershed. The agencies or groups that have collected water quality data include the MWRD, BCCWP, Volunteer Lake Monitoring Program (VLMP) and the LCHD-ES.

3.15.1 Metropolitan Water Reclamation District of Greater Chicago

Since the 1970s, the MWRD has been monitoring dissolved oxygen, temperature, chloride, total phosphorus, total kjeldahl nitrogen, total suspended solids, calcium, fecal coliform and conductivity at the USGS stream gaging station in Buffalo Creek. Based on a review of their historic data, levels of chloride in the water within Buffalo Creek have been increasing while total phosphorus levels have been decreasing (see Figure 3-54). Decreases in total phosphorus levels in the last 40 years are likely the result of agricultural land use being converted to urban land uses and removal of phosphates from detergents and other household products. However, increases in chloride levels are also likely the result of this shift in land use. The increased amount of impervious cover associated with increased urban land use has likely increased the chloride levels in the Buffalo Creek Watershed.

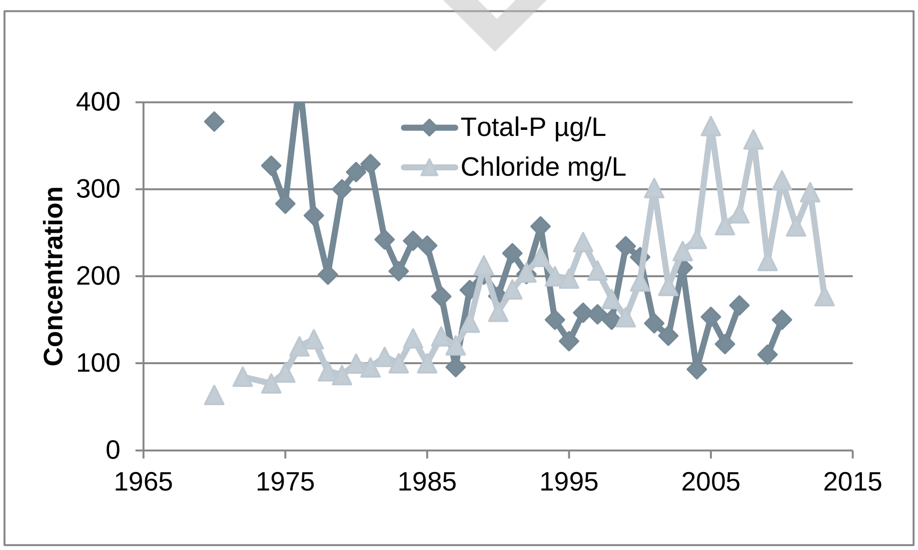


Figure 3-54: MWRD Historical Data Buffalo Creek – Chloride and Total Phosphorus.

3.15.2 Buffalo Creek Clean Water Partnership

MS4 (Municipal separate storm sewer system): *A conveyance or system of conveyances that is owned by a state, city, town village, or other public entity that discharges to waters of the U.S and is designed or used to collect or convey stormwater (pipes, ditches etc.).*

First Flush Runoff: *The storm-event runoff that occurs at the beginning of a rainstorm of a defined threshold. The first flush carries concentrations of pollutants that have accumulated on the ground during the period of drier weather between storms. Communities often struggle to adequately define what depth of rainfall constitutes a first flush, and how it is influenced by frequency and intensity of rainfall. First flush is a metric for gaining compliance with stormwater regulations (Phase II of the NPDES and total maximum daily load (TMDL)).*

The BCCWP was formed in April 2012. At the second stakeholders meeting on June 28, 2012, the members present voted water quality the highest priority issue for the group to address. After this meeting, BCCWP leaders Marcy Knysz and Jeff Weiss collected and reviewed all available water quality sampling data and recognized that the water quality sampling effort was infrequent and uncoordinated, resulting in limited usefulness of the water quality data to identify sources of pollutants or assess trends in watershed water quality. Key deficiencies in the existing water quality sampling effort included the following:

- Lack of water quality monitoring at key points in the watershed.
- Lack of frequent monitoring to identify seasonal trends and pollutants at different flow rates.
- No analysis available for lake sediments, which contribute to problems of eutrophication, suspended solids and low dissolved oxygen.
- Inconsistent testing regimes, conducted at different times by communities within the watershed, making it impossible to compare data across the watershed.

As a result of the data analysis, the BCCWP designed a Coordinated Pollutant Monitoring Program (PMP) for the Buffalo Creek watershed, received funding through a Watershed Management Assistance Grant from the Lake County Stormwater Management Commission (SMC), and secured participation from the eight villages with significant land area in the Buffalo Creek watershed. The PMP included 1.) sediment sampling in Albert Lake and Buffalo Creek Reservoir, 2.) 2 years of monthly water quality sampling at 2 locations between April and October, 3.) 2 years of water quality testing at 13 locations, and 4.) collection of "first flush" samples.

Photo of BCCWP volunteers and EMT staff collecting water samples. Photo by M. Knysz.

The goal of the PMP is to establish a coordinated, efficient monitoring program that makes the most of community and agency investment to assess water quality trends over time. In addition the PMP should be sufficient to be used to optimize BMP locations and address water quality impairments across the Buffalo Creek Watershed. The PMP will enable water quality issues to be addressed across community and county borders, and build the spirit of cooperation needed to address other watershed issues, such as flooding, erosion and habitat quality.

The BCCWP also formed a technical committee, with significant participation from Tom Murphy, retired professor of environmental chemistry at DePaul University. The technical committee worked to determine water quality testing locations and parameters for the PMP. The information outlined in this section was obtained from the Buffalo Creek Clean Water Partnership's 2013 and 2014 Water Quality Reports.

The PMP included 13 ***Municipal Separate Storm Sewer System*** (***MS4)*** water quality sampling locations (BC1-BC13, see Figure 3-55). In 2013 and 2014 water quality sampling occurred at these sites twice each year. Monthly sampling was conducted from April to October at two additional stations (known as Creekside and Checker). ***"First flush runoff"*** samples were collected by autosamplers placed at the Creekside and Checker sampling stations, in order to measure the presence of pollutants washed from roads and other land surfaces in the early stages of a storm event.. Consistent timing and methods were used for all sampling, with a single lab collecting samples and coordinating the testing across the watershed. Environmental Monitoring and Technology, Inc. (EMT) used a consistent panel of water quality tests and parameters to assess the quality of the stormwater runoff. Volunteers from BCCWP provided consolidated reporting and analysis. Sample collection timing, methods and parameters were consistent with those performed by MWRD at their Buffalo Creek station. Analysis of the stream flow data from the USGS stream gaging station on Buffalo Creek near Wheeling was performed. In-stream flow velocity and channel depth measurements were collected at the Creekside and Checker sites and all 13 MS4 locations on October 7, 2013.

All locations were sampled on May 6, 2013, October 7, 2013, May 5, 2014 and October 6, 2014. The results are summarized in Table 3-38 to 3-41 and Figures 3-56 through 3-66. The test results were compared against the generally accepted limits for each parameter.

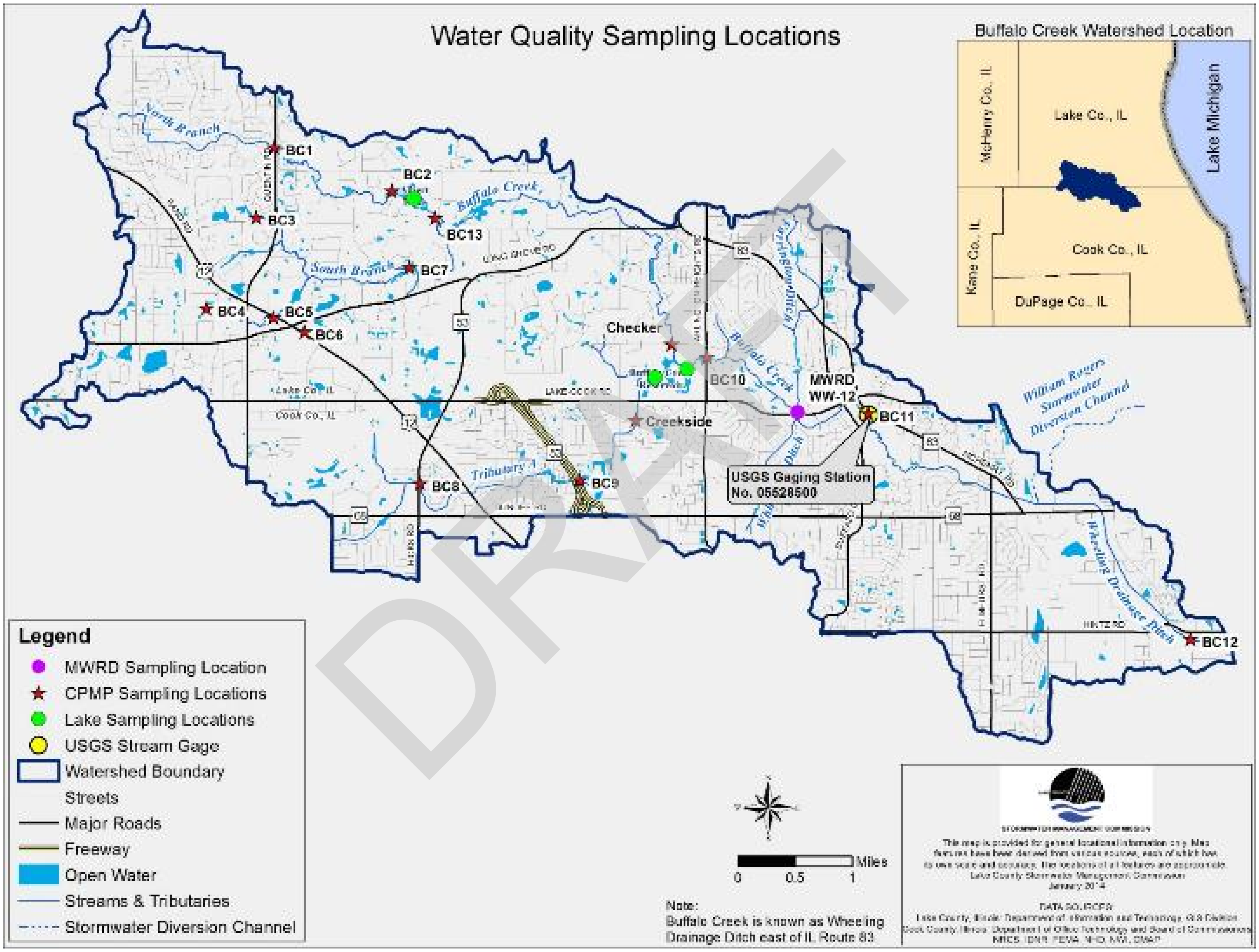


Figure 3-55: Buffalo Creek Watershed Water Quality Sampling Locations.

Noteworthy: Accepted Water Quality Limits

Water Quality Parameter	Reference	Accepted Limits
Chloride	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.304	500 mg/L
Phosphorus, Total	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.205	0.05 mg/L
Fecal Coliform	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.209	200 cfu/100 ml geometric mean based on a minimum of 5 samples taken over any 30 day period; 400 cfu/100 ml maximum not to be exceeded in more than 10% of samples taken during any 30 day period.
Total Kjeldahl Nitrogen	Standards Methods for the Examination of Water and Wastewater, 1999	20 mg/L
Total Suspended Solids	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 304 Effluent Standards	15.0-30.0 mg/L
Total Dissolved Solids	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.304	1000 mg/L
Dissolved Oxygen	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.206	March - July at least 5.0 August – February at least 3.5
BOD	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 304 Effluent Standards.	<8.0 mg/L
Conductivity	USEPA Volunteer Stream Monitoring Manual, 1997	50.0 – 1500.00 µs/cm
Temperature (°F)	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.211	December – March 60.0°F Max April – February 90.0°F Max
pH	Illinois Administrative Code. Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board; Part 302 Water Quality Standards Section 302.304	6.5 – 9.0, except for natural causes

Table 3-38: 2013 Buffalo Creek Watershed Pollutant Monitoring Program Water Quality Testing Results (May 6, 2013).

Parameter Unit	Cl- mg/L	DO mg/L	BOD mg/L	Total P mg/L	TDS mg/L	TSS mg/L	Kjeldahl N mg/L	Temp °F	Cond µs/cm	pH	Fecal Coliform cfu/100 mL
Target Limits	500	At least 5.0	8.0	0.05	1,000	15-30	20	90 °F Max	>1,500	6.5-9.0	400 max
BC1	196	13.1	5.8	0.119	616	12	1.39	53	1,448	8.18	70
BC2	177	13.9	5	0.027	642	3	1.67	57	1,448	8.26	>860
BC3	354	9.1	5.7	0.03	774	4	2.23	60	1,925	7.95	>1,200
BC4	153	9.5	7.2	0.091	484	39	1.67	60	1,231	8.13	150
BC5	174	13.2	6	0.051	552	<10	1.39	58	1,362	8.39	130
BC6	975	10.5	5.2	0.035	1690	9	1.39	61	4,165	8.48	<10
BC7	330	9.3	7.9	0.176	790	63	2.23	60	1,920	8.2	30
BC8	263	10.3	7	0.059	762	15	1.67	60	1,720	8.01	260
BC9	316	13.8	12.5	0.069	852	21	9.19	62	1,906	8.41	100

BC10	246	11.1	9.1	0.082	680	29	1.67	62	1,605	8.28	<10
BC11	246	14.4	23.7	0.074	734	12	2.23	65	1,668	8.73	60
BC12	270	14.3	6.2	0.068	766	10	1.67	65	1,717	8.58	60
BC13	165	11.1	2	0.236	526	45	1.39	64	1,253	8.57	10
Checker	218	10.8	7.5	0.088	632	18	1.39	60	1,537	8.07	70
Creekside	296	11	5.8	0.041	786	<10	1.67	41	1,797	7.97	30
MWRD	231	5.3	3	<0.2	774	12	<1.0	62	1,242	7.34	30
Average	288	11	7	0.08	754	21	2	59	1,747	8	83

Bold denotes levels above the target limit.

Table 3-39: 2013 Buffalo Creek Watershed Pollutant Monitoring Program Water Quality Testing Results (October 7, 2013).

Parameter Unit	Cl- mg/L	DO mg/L	BOD mg/L	Total P mg/L	TDS mg/L	TSS mg/L	Kjeldahl N mg/L	Temp °F	Cond µs/cm	pH	Fecal Coliform cfu/100 mL
Target Limits	500	At least 5.0	8.0	0.05	1,000	15-30	20	90 °F Max	>1,500	6.5-9.0	400 max
BC1	143	8.9	3	0.079	374	22	1.25	54.7	749	7.58	1100
BC2	131	9.2	<3.0	0.073	324	<15	0.84	56.1	765	8.00	440
BC3	182	3.3	4	0.125	468	16	1.11	56.1	863	7.30	540
BC4	245	-	4	0.093	876	76	1.53	57.6	1030	7.71	760
BC5	317	7.9	3	0.154	844	18	1.25	55.6	1720	7.95	>120
BC6	428	3.3	12.3	0.25	816	31	3	63.9	1980	7.70	960
BC7	229	11.2	4	0.124	570	<15	1	57.4	1070	8.00	460
BC8	294	7.5	3.1	0.076	786	<15	0.56	60.2	1600	7.95	>1500
BC9	135	5.2	4	0.18	352	<15	1.39	61.2	639	7.90	>3000
BC10	149	11.2	5.8	0.15	1,090	24	1.11	63.14	704	8.40	>1300
BC11	116	8.8	4.5	0.127	340	19	1.25	63.9	623	7.90	>1900
BC12	108	9.2	4.9	0.15	312	<15	0.975	63.7	575	7.70	>2400
BC13	119	6.7	4.2	0.18	424	30	1.11	58.5	713	7.90	360
Checker	186	9.1	3.2	0.19	562	19	0.56	58.8	910	8.00	840
Creekside	148	8	4.2	0.126	358	<15	0.84	66.0	709	7.82	>1800
MWRD	113	7.2	3	<0.2	636	18	<1.0	75.2	378	7.87	3400
Average	190	7.8	4.4	0.14	571	27	1.2	60.8	939	7.86	984

Bold denotes levels above the target limit.

Table 3-40: 2014 Buffalo Creek Watershed Pollutant Monitoring Program Water Quality Testing Results (May 5, 2014).

Parameter Unit	Cl- mg/L	DO mg/L	BOD mg/L	Total P mg/L	TDS mg/L	TSS mg/L	Kjeldahl N mg/L	Temp °F	Cond µs/cm	pH	Fecal Coliform cfu/100 mL
Target Limits	500	At least 5.0	8.0	0.05	1,000	15-30	20	90 °F Max	>1,500	6.5-9.0	400 max
BC1	322	10.9	<4	<0.05	902	<15	<2.5	47.4	1710	8.2	52
BC2	272	13.9	8	<0.05	858	<15	<2.5	48.5	1590	7.14	14
BC3	735	8.6	<5	.072	1500	<15	<2.5	52.2	2940	8.12	16

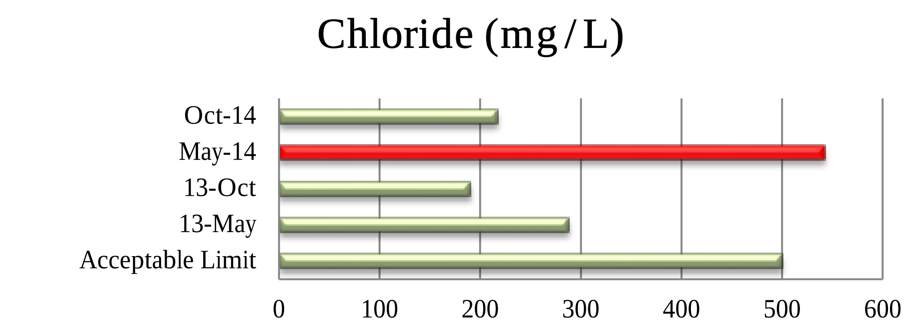
BC4	220	11.4	10	0.078	702	22	<2.5	52.3	1350	8.7	100
BC5	326	9.6	<4	0.057	922	<15	<2.5	48.2	1740	7.92	>130
BC6	2700	13.5	10	0.065	4350	43	<2.5	53.1	8420	8.04	<2
BC7	546	16.2	<3	<0.05	1250	<15	<2.5	51.7	2400	8.37	48
BC8	414	10.9	6	0.068	1050	<15	<2.5	51.9	2000	8.32	48
BC9	491	12	<4	<0.05	1100	21	<2.5	54.6	2230	8.74	58
BC10	383	9.6	<5	<0.05	1250	20	<2.5	55	1850	8.53	4
BC11	404	15.8	<4	<0.05	934	18	<2.5	57.6	1910	8.04	20
BC12	418	15.5	<5	0.061	904	<15	<2.5	56.6	1940	7.74	32
BC13	244	11.6	6	0.142	770	28	<2.5	55.8	1360	7.48	8
Checker	326	17.8	<4	0.063	918	<15	<2.5	55.7	1650	7.93	38
Creekside	499	15.4	6	0.05	1080	15	<2.5	56.2	2180	8.04	24
MWRD	382	10.5	4	<0.2	996	12	1.2	53.6	1730	8.24	20
Average	542.6	12.7	5.5	0.1	1,217.9	18.7	2.4	53.2	2,312.5	8.1	38.4

Bold denotes levels above the target limit.

Table 3-41: 2014 Buffalo Creek Watershed Pollutant Monitoring Program Water Quality Testing Results (October 7, 2014).

Parameter	Cl-	DO	BOD	Total P	TDS	TSS	Kjeldahl N	Temp	Cond	pH	Fecal Coliform
Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ºF	µs/cm		cfu/100 mL
Target Limits	500	At least 5.0	8.0	0.05	1,000	15-30	20	90 ºF Max	>1,500	6.5-9.0	400 max
BC1	151	9.98	3	0.046	572	14	0.840	51.8	1050	7.7	420
BC2	150	10.8	3	0.046	588	10	0.98	52.52	1190	7.5	>300
BC3	165	7.89	6	0.079	594	<3.10	0.840	53.1	963	7.3	>200
BC4	157	10.8	5	0.066	520	99	1.4	50.4	1020	7.5	440
BC5	224	10.1	4	0.048	712	20	1.12	51.8	1340	7.5	>250
BC6	491	9.03	6	0.059	932	97	1.12	58.6	1890	7.2	600
BC7	224	10.9	4	0.08	596	4	0.98	53.8	767	7.5	>190
BC8	277	11.5	5	0.078	730	8	1.96	53.8	1470	7.3	>240
BC9	259	10.2	6	0.088	704	13	1.68	55.2	1350	7.47	400
BC10	215	9.98	5	0.035	536	5	1.4	56.1	1180	7.29	92
BC11	238	10.1	6	0.033	632	4	1.12	56.8	1280	7.29	>160
BC12	213	10.5	3	0.057	598	5	1.68	57.9	1200	7.42	>200
BC13	120	13.1	4	0.058	420	10	1.4	57.2	872	7.2	700
Checker	163	11.4	4	0.027	566	11	1.12	54.1	1070	7.5	420
Creekside	234	8.54	3	0.096	618	10	1.68	57.2	1210	7.57	>270
MWRD	196	9.3	<2	<0.2	582	<4	<1.0	55.8	918	7.2	240
Average	217.3	10.3	4.3	0.1	618.8	19.8	1.3	54.8	1,173.1	7.4	320.1

Bold denotes levels above the target limit.



	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Chloride (mg/L)	500	288	190	542.6	217.3

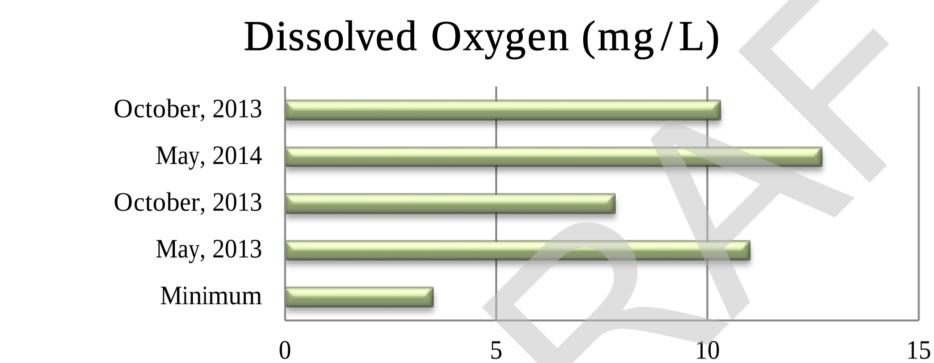
Red denotes levels above the acceptable limit.

Figure 3-56: Average Chloride (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.

Noteworthy: Chloride Standards

Illinois EPA: 500 mg/L

USEPA: 230 mg/L



	Minimum	May, 2013	October, 2013	May, 2014	October, 2013
Dissolved Oxygen (mg/L)	3.5	11	7.8	12.7	10.3

Figure 3-57: Average Dissolved Oxygen (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.

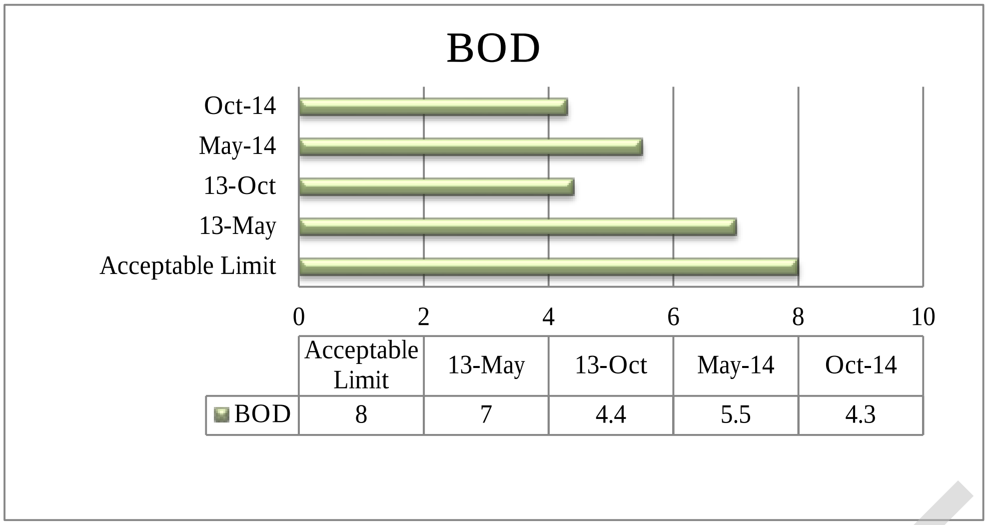


Figure 3-58: Average Biochemical Oxygen Demand Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.

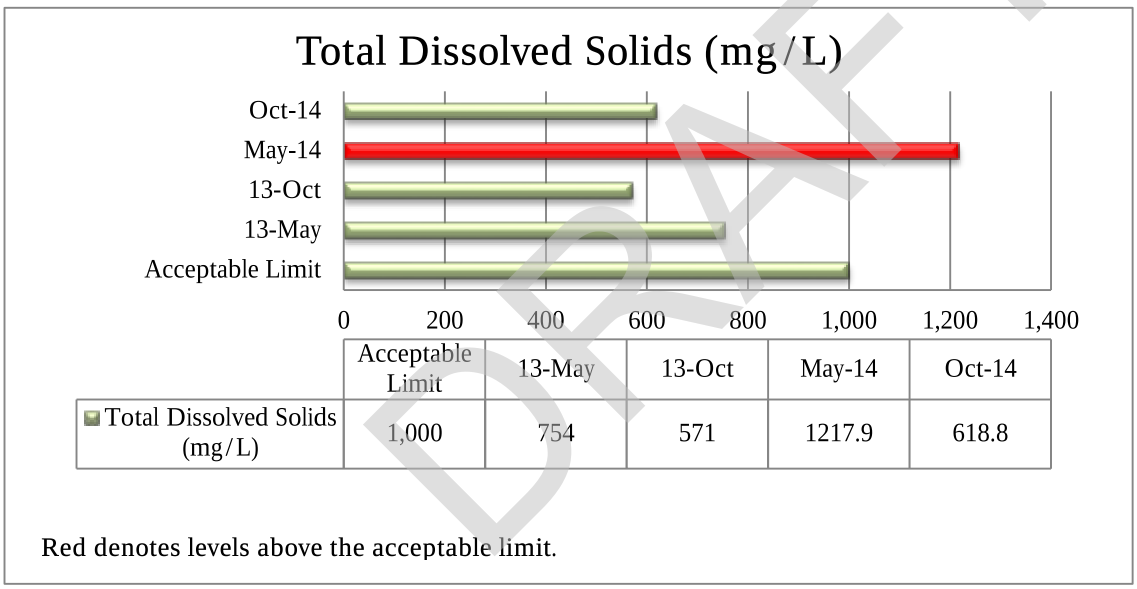
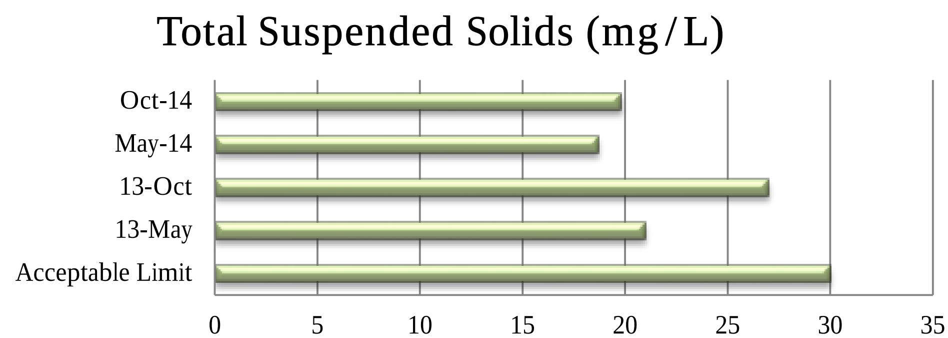
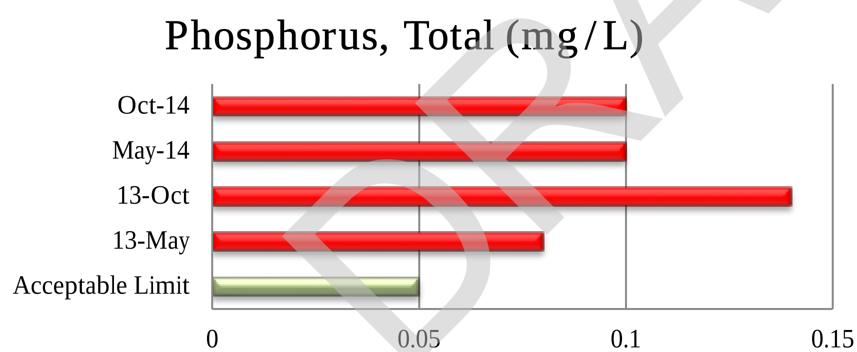


Figure 3-59: Average Total Dissolved Solids (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Total Suspended Solids (mg/L)	30	21	27	18.7	19.8

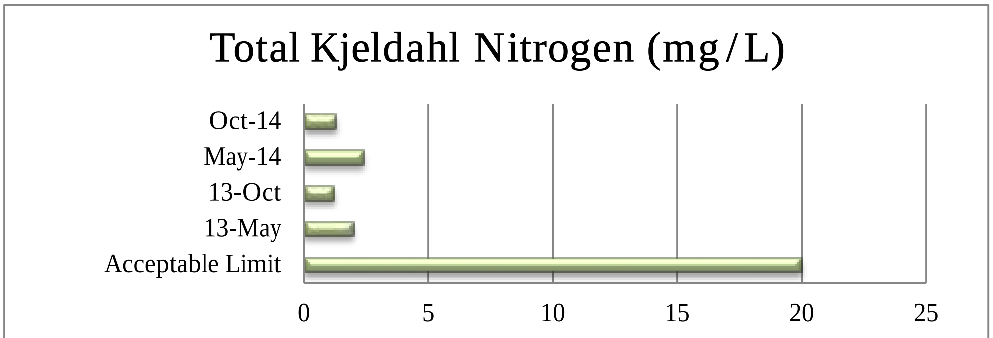
Figure 3-60: Average Total Suspended Solids (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Phosphorus, Total (mg/L)	0.05	0.08	0.14	0.1	0.1

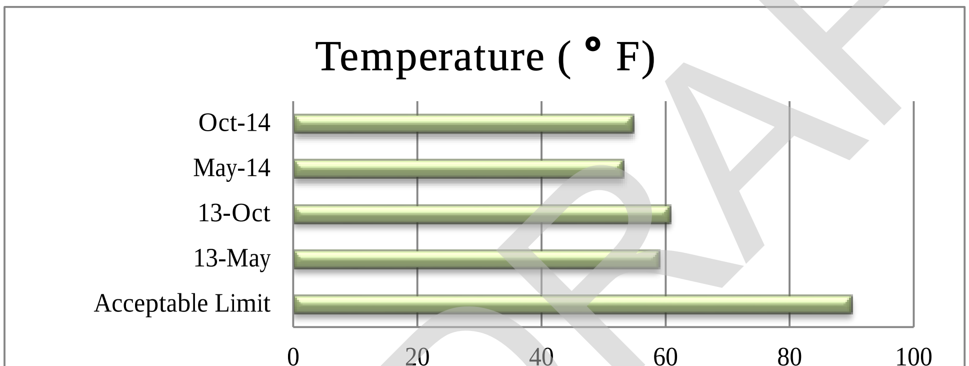
Red denotes levels above the acceptable limit.

Figure 3-61: Average Total Phosphorus (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



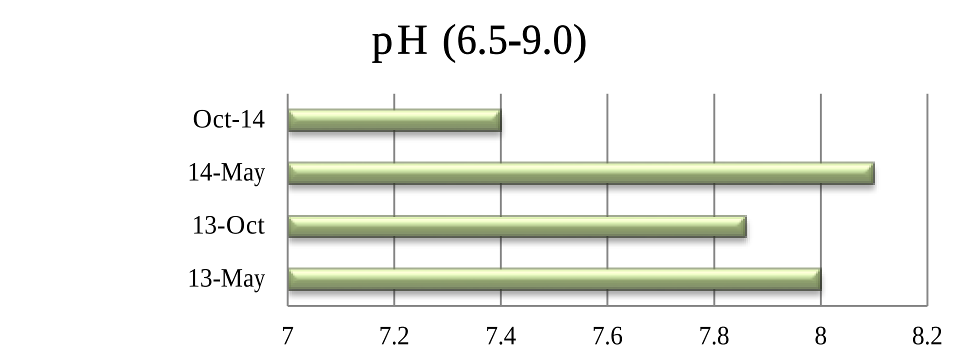
	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Total Kjeldahl Nitrogen (mg/L)	20	2	1.2	2.4	1.3

Figure 3-62: Average Total Kjeldahl Nitrogen (mg/L) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



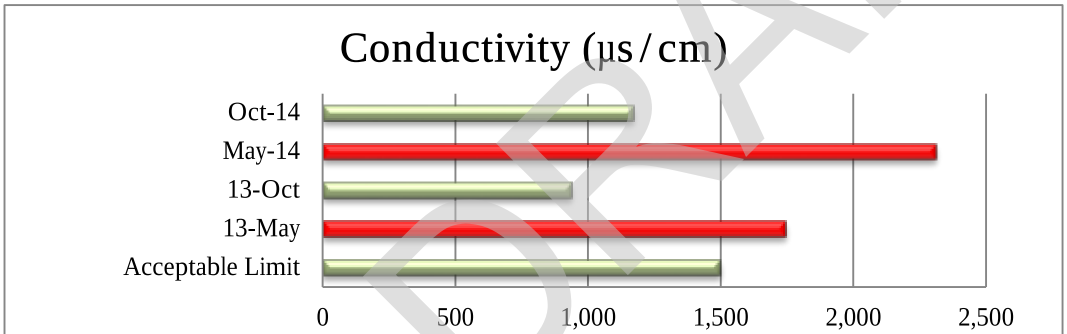
	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Temperature (°F)	90	59	60.8	53.2	54.8

Figure 3-63: Average Temperature (°F) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



	13-May	13-Oct	14-May	Oct-14
pH (6.5-9.0)	8	7.86	8.1	7.4

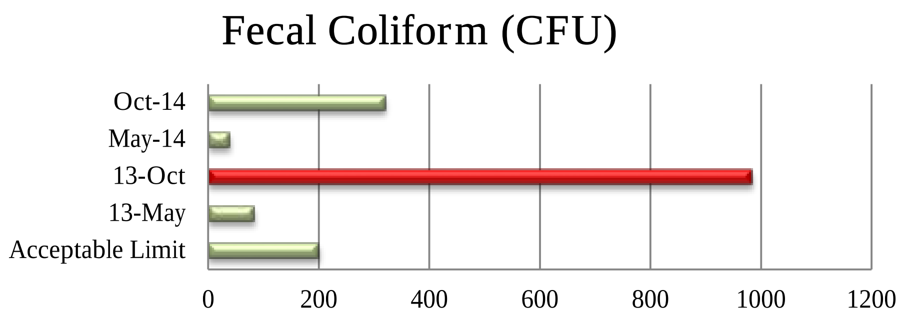
Figure 3-64: Average pH Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Conductivity (µs/cm)	1,500	1747	939	2312.5	1173.1

Red denotes levels above the acceptable limit.

Figure 3-65: Average Conductivity (µs/cm) Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.



	Acceptable Limit	13-May	13-Oct	May-14	Oct-14
Fecal Coliform (CFU)	200	83	984	38.4	320.1

Red denotes levels above the acceptable limit.

Figure 3-66: Average Fecal Coliform Concentration Across All Sample Locations in the Buffalo Creek Watershed, 2013-2014.

Water quality data collected by the PMP indicates there are multiple pollutants that exceed acceptable limits. The average for all sample locations each year exceeded the acceptable standard for total phosphorus. Average conductivity limits were exceeded in May of 2013 and 2014. The average fecal coliform exceeded the acceptable limit in October of 2013. Chloride, dissolved oxygen, BOD, total dissolved solids, total suspended solids, total kjeldahl nitrogen, temperature and pH exceeded acceptable limits at a limited number of sample locations. Based on the water quality data collected by PMP the primary water quality parameters of concern in the Buffalo Creek Watershed are total phosphorus, conductivity and fecal coliforms.

3.15.3 Chloride Monitoring

Chloride ions enter waterways through various means. In the Midwest, the most common source is from winter road maintenance operations. Road salt, which is primarily composed of sodium chloride, enters water either directly or more commonly during snow melt.

High chloride concentrations in waters can have negative impacts on aquatic life, and since the chloride ion is highly mobile, it can also seep into groundwater sources, some of which are used by people as their primary source of drinking water. The USEPA has a chronic standard for aquatic life of 230 mg/L. The Illinois EPA has a drinking water standard of 250 mg/L and a general use standard of 500 mg/L.

In late winter 2014 and 2015, the LCHD-ES and SMC conducted chloride monitoring in streams at numerous locations in Lake County around the time of significant snowmelt. Several sites were selected within the Buffalo Creek Watershed (Checker Road, Harvard Street Bridge, Schaeffer Road, and Long Grove Road). Sites were screened with a probe for conductivity as a surrogate for chloride concentrations. Conductivity and chloride are strongly correlated. Roughly, a conductivity reading of 2.0 mS/cm corresponds to a chloride concentration of 500 mg/L. A few water samples were taken and analyzed at the LCHD lab for chloride.

Table 3-42 shows the results for all sampled sites throughout the County. Note that over half of the sites had conductivity readings that were >2.0 mS/cm (i.e., exceeding the state general use standard). Buffalo Creek sites were similar with 57% and 72% exceeding 2.0 mS/cm in 2014 and 2015, respectively. The highest conductivity reading (11.8 mS/cm) in 2014 was on February 19th at a culvert on Schaeffer Road in Cook County. The highest conductivity reading (4.6 mS/cm) in 2015 was on March 9th at Long Grove Road.

The data represent only a “snapshot” of the situation. The readings were done *in-situ* and do not constitute continuous concentration data. Stream flow was also not recorded, so the true loading to the stream was not calculated. However, it does illustrate the potential impact that road salt is having on our aquatic resources.

Table 3-42: Conductivity and Maximum Chloride Concentrations at All Sites in Lake County in 2014 and 2015 During Snow Melt.

All Sites in Lake County					
Year	Sites	Min Conductivity	Max Conductivity	Max Chloride	% > 2 mS/cm
2014	25	0.553	70.42	8,450	51.00%
2015	39	1.004	91.02	33,400	67.70%

3.15.4 Flush Sample Analysis

Events such as melting snows and heavy rainfalls tend to carry elevated levels of pollutants into receiving waters in urban streams. An extraordinary event occurred on June 26, 2013. Between 3 and 11 am, 5.36 inches of precipitation was recorded at the Buffalo Grove rain gage. The runoff resulted in severe flooding issues in Buffalo Grove and surrounding communities. The resulting stream flows set an all-time record at the USGS Buffalo Creek stream gage since measurements began in 1952, with a measured discharge rate of 665 cubic feet per second.

BCCWP volunteers had set two ISCO autosamplers to collect twelve water samples at thirty minute intervals during a rising stream stage at the sites where monthly sampling occurred during 2013. Samples from each autosampler were collected and composited at 11:30 am on June 25, and submitted to the testing laboratories for analysis in order to assess peak pollutant transport rates during a flood event. Levels of three pollutants were compared based on average flow to the next highest values recorded for each site during monthly sampling (100 times average flow of 6 cubic feet per second) and the next highest level recorded for each.

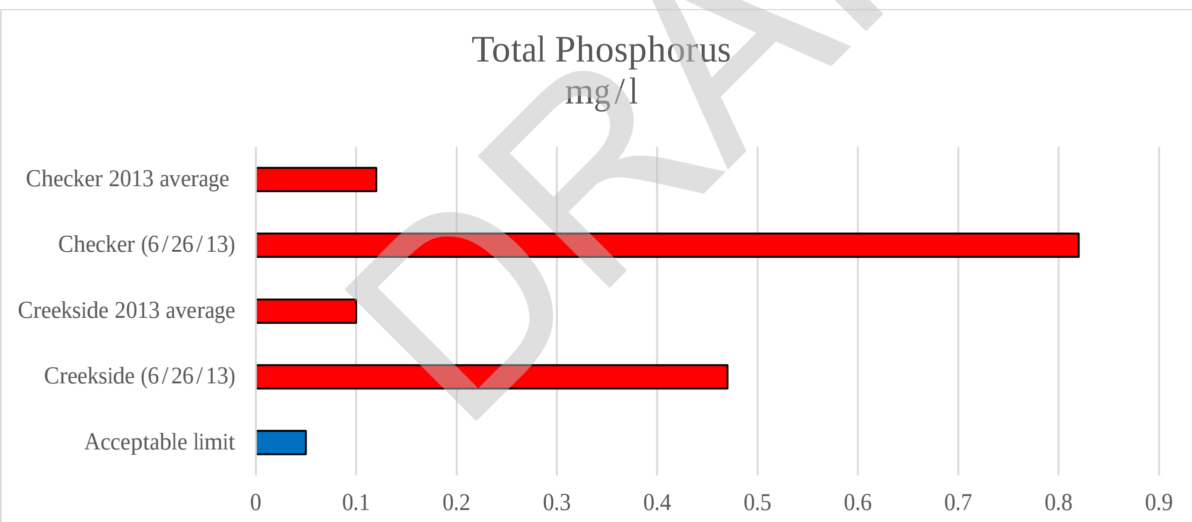


Figure 3-67: Concentration of Phosphorus During Storm Event of June 26, 2013 Versus Annual Average, 2013.

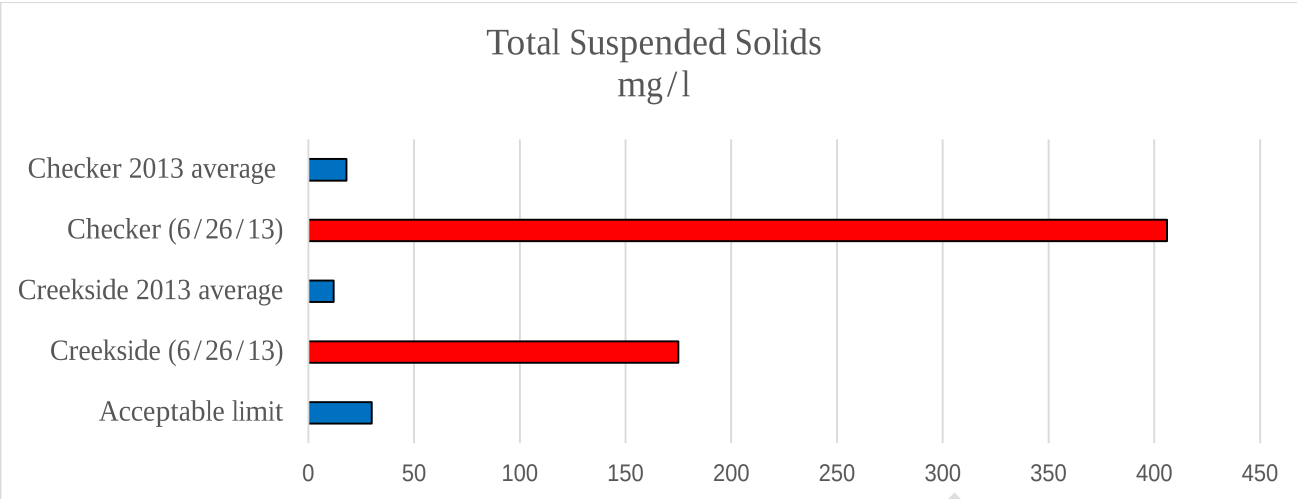


Figure 3-68: Concentration of Total Suspended Solids During Storm of June 26, 2013 Versus Annual Average, 2013.

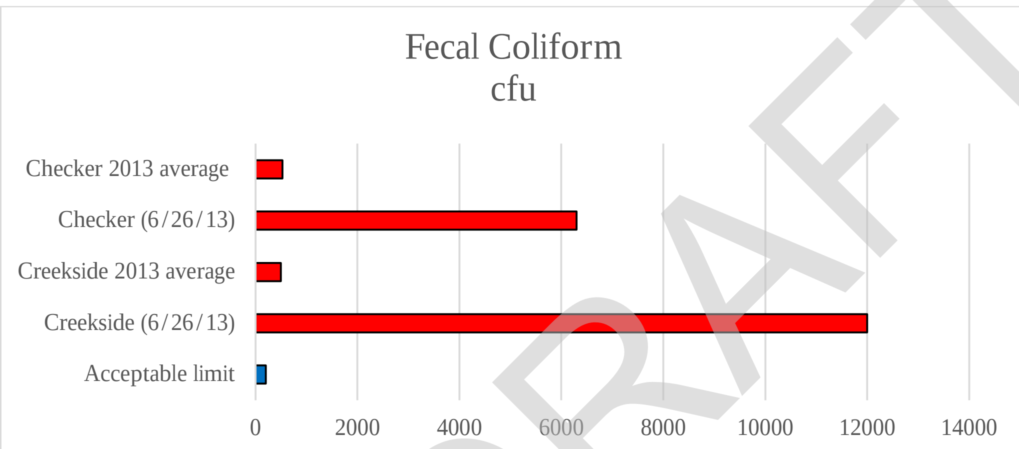


Figure 3-69: Concentration of Fecal Coliform During Storm of June 26, 2013 Versus Annual Average, 2013.

To provide a perspective on the relative amount of pollution that was transported during the storm, Table 3-43 shows a "flow-adjusted increase" calculation when the increased concentration is multiplied by the increased flow carried by Buffalo Creek on June 26, 2013. For example, there was 683 times more phosphorus than the average level at Creekside Park during the event. In addition, new debris jams and fresh evidence of erosion of streambanks and lake shorelines were observed following the event.

Table 3-43: Pollution Transport During Flood Event of June 26, 2013

Location	Total Phosphorus mg/l	Fecal Coliform cfu	Total Suspended Solids mg/l
Checker 2013 average	0.12	531	18
Checker (6/26/13)	0.82	6300	406
Flow-adjusted increase	683 times	1186 times	2255 times
Creekside 2013 average	0.1	500	12
Creekside (6/26/13)	0.47	12000	175
Flow-adjusted increase	470 times	2400 times	1458 times
Acceptable limit	0.05	200	30

3.15.5 Lake Sediment Sampling

In 2013, LCHD-ES collected sediment samples for the BCCWP as part of the PMP. Three composite samples were taken at the following locations: Albert Lake and Buffalo Creek Reservoir (BCR-1, and BCR-2). The samples were analyzed for 136 parameters. Of the 136 parameters analyzed, 7 were above listed sediment quality guidelines in Albert Lake and 10 in Buffalo Creek Reservoir (BCR-1 and BCR-2).

The sediment quality standards used to determine if the pollutants were above normal limits was McDonald et al., 2000 and Mitzelfelt, 1996.

- McDonald used two Standard Quality Guidelines (SQG): the threshold effect concentration (TEC) and the probable effect concentration (PEC). The TEC's were intended to identify contaminant concentrations below which harmful effects on sediment dwelling organisms are not expected (Smith et al. 1996; US EPA 1996a). The PEC's were intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms were expected to occur frequently (MacDonald et al. 1996; Swaru 1999).
- Mitzelfelt either described the contaminant as elevated or highly elevated in the soils. These classifications were assigned by deviation from mean concentrations found from 273 samples of 63 Illinois lakes.

<u>Albert Lake:</u> The sediments in Albert Lake whose values exceeded the SQG's, also exceeded McDonald's TEC standards. Copper concentration was 36.8 mg/Kg-dry and Nickel concentration was 28.8 mg/Kg-dry, which are both above the minimum TEC of 31.6 mg/Kg-dry for Copper and 22.7 mg/Kg-dry for Nickel. The Silver concentration is considered highly elevated with a concentration of 4.38 mg/Kg-dry based on Mitzelfelt. The concentration of Mercury was above the TEC, PEC and considered elevated under Mitzelfelt at 1.49 mg/Kg-dry. While mercury was found in the samples, it may be bound to the sediment and poses minimal risk. However this information may affect any sediment removal projects in the future.

It is suspected that the source of at least some of the metals is the old Lake Zurich sewage treatment plant that discharged into the creek upstream of Albert Lakethe southeast branch of the Lake Zurich sewage treatment plant was located upstream of Albert Lake at Old Mill Grove Road, south of Rt. 22. From 1986 through 1988 the southeast branch of the Lake Zurich sewage treatment plant exceeded discharge limitations for multiple pollutants including biological oxygen demand, total suspended solids and fecal coliforms. The northwest branch of the Lake Zurich sewage treatment plant also regularly violated discharge limitations, which ultimately led to its closing in 1989. The southeast branch of the Lake Zurich sewage treatment plant was closed in 1993 and water was rerouted to the Lake County sewage treatment plant in Buffalo Grove.

<u>Buffalo Creek Reservoir:</u> The copper concentration in the sediment of BCR-2 was above the TEC of 31.6 mg/Kg-dry, however it was not considered elevated under Mitzelfelt. The silver concentration from the sample collected in BCR-1 was considered highly elevated by Mitzelfelt, with a concentration of 3.48 mg/Kg-dry. The concentration of mercury in BCR-1 was above the TEC and is considered elevated.

The results of the sediment sampling in both lakes are summarized in Table 3-44. Inorganic compounds such as metals are not biodegradable in aquatic ecosystems and often become locked up in the sediment. However, some metals can be released from the sediment, where they are assimilated into the tissues of aquatic organisms such as fish. For example, trace amounts of mercury are regularly found in fish tissue and can pose a health risk to humans. Identifying lakes with high metal concentration will assist with prioritizing future remediation efforts.

Table 3-44: 2013 Sediment Sampling Results in Albert Lake and Buffalo Creek Reservoir.

Analyte	Units	Albert Lake	BCR-1	BCR-2	MacDonald, et al. 2000		Mitzelfelt, 1996	
					TEC	PEC	Elevated	Highly Elevated
Copper	mg/Kg-dry	36.8	25.2	34.8	31.6	149	100 to <590	590 or greater
Nickel	mg/Kg-dry	28.8	17.6	21.3	22.7	48.6	31 to <43	43 or greater
Silver	mg/Kg-dry	4.38	3.48	<3.8	NA	NA	0.1 to <1.0	1.0 or greater

Mercury	mg/Kg-dry	1.49	0.46	0.10	0.18	1.06	0.15 to <7.01	7.01 or greater

Bold text indicates amounts exceeding thresholds.

3.15.6 Volunteer Lake Monitoring Program

In 2012 and 2013, Buffalo Creek Reservoir had two VLMPs participating in modified Tier II monitoring. They actively monitored the basins for water clarity (Secchi depth) and DO, additionally collecting water samples for chlorophyll a. Chlorophyll a is a pigment found in phytoplankton that can be quantified and used as a measure of primary productivity. The goal of the VLMP is to collect data every two weeks from May through August. Buffalo Creek Reservoir had four VLMP sites selected for monitoring, two in each of the basins (BCR-1 and BCR-2) that make up the entire reservoir. The results of the VLMP Secchi data for 2012 and 2013 are summarized in Figure 3-70 as annual average Secchi depths. The results of the 2013 VLMP monitoring indicate that the water clarity in BCR-1 is better than BCR-2. This agrees with the results from water clarity monitoring conducted in the basins in 2013 by the LCHD-ES (Buffalo Creek Reservoir Summary Report, 2013).

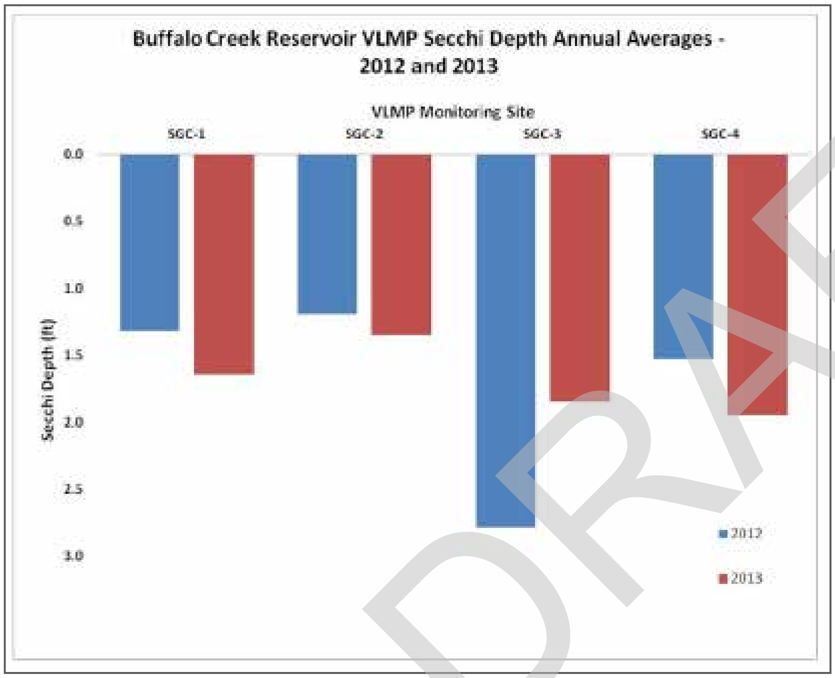


Figure 3-70: 2012 and 2013 VLMP Tier-2 Average Annual Secchi Depths.

Photo of Secchi disc in use by VLMP volunteers. Photo courtesy of J. Weiss.

Noteworthy: Illinois Volunteer Lake Monitoring Program (VLMP)

Illinois EPA established the VLMP in 1981 to protect Illinois lakes. The Illinois VLMP utilizes citizen volunteers to assist in gathering lake water quality data from May through October annually. Participation in the VLMP The increases citizen awareness of the factors that affect water quality, and develops grass roots local support for environmental programs. The data collected by citizen volunteers provides historic water quality data to support and guide decision making. In 2006, the VLMP was re-organized to address the ever-increasing need for reliable data to support environmental decision-making and regulations. To meet this need, a new structure base for the VLMP was developed, called the Tiered Approach. This structure was developed to take into account the needs of both the Illinois EPA and the volunteers by establishing different levels of volunteer participation and data use. The Tiered Approach allows volunteers the freedom to choose their level of participation in the program that suits their needs while still providing Illinois EPA with reliable data to make lake assessments, which are required by Section 305(b) of the Federal Clean Water Act.

Tier Summary:

Tier 1: In this tier, volunteers perform Secchi disk transparency monitoring and record field observations. Monitoring is conducted twice per month from May through October typically at 3 in-lake sites.

Tier 2: In addition to monitoring Secchi disk transparency, Tier 2 volunteers enter the advanced water quality program by collecting water samples for nutrients, suspended solids, and chlorophyll analyses at 1 Site. Water quality and chlorophyll samples are taken once per month in May – August in conjunction with one Secchi transparency monitoring trip.

Tier 3: This is the most intensive tier. In addition to monitoring Secchi disk transparency, Tier 3 volunteers are also part of the advanced water quality program and collect water and chlorophyll samples at up to 3 sites on their lake. As in Tier 2, their samples are analyzed for nutrients, suspended solids, and chlorophyll. This tier may also include Dissolved Oxygen/Temperature profiles as monitoring equipment is available. As in Tier 2, water quality and chlorophyll samples are taken once per month from May – August and October in conjunction with one Secchi transparency monitoring trip.

More information on the program can be found on the Illinois EPA webpage www.epa.illinois.gov.

3.15.7 Illinois RiverWatch Network

In addition to physiochemical indicators of water quality like phosphorus and dissolved oxygen, the diversity and abundance of aquatic organisms also helps paint a picture of watershed health. The data summarized in Table 3-46 were gathered by the Illinois RiverWatch Program, a program of the IDNR that relies on volunteer monitoring by trained citizens in order to evaluate the health of a stream or river. Data was gathered via biological monitoring and stream habitat surveys and compiled by IDNR trained Citizen Scientists. Table 3-45 provides a brief summary of the measures. The sampling locations can be found in Figure 3-71. All of these sites are Illinois RiverWatch Program sites.

Table 3-45: Summary of Illinois RiverWatch Measures.

Measure	Summary
Macroinvertebrate Biotic Index (MBI)	Rates stream health using organisms tolerant to pollution and sample density. The lower the MBI score, the better the stream quality.
EPT Score	Evaluates the number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). EPT species richness increases with stream water quality.
Total Taxa Richness (TXR)	Total number of taxa (out of a total of 37 indicator taxa) identified by the volunteers at each monitoring site.

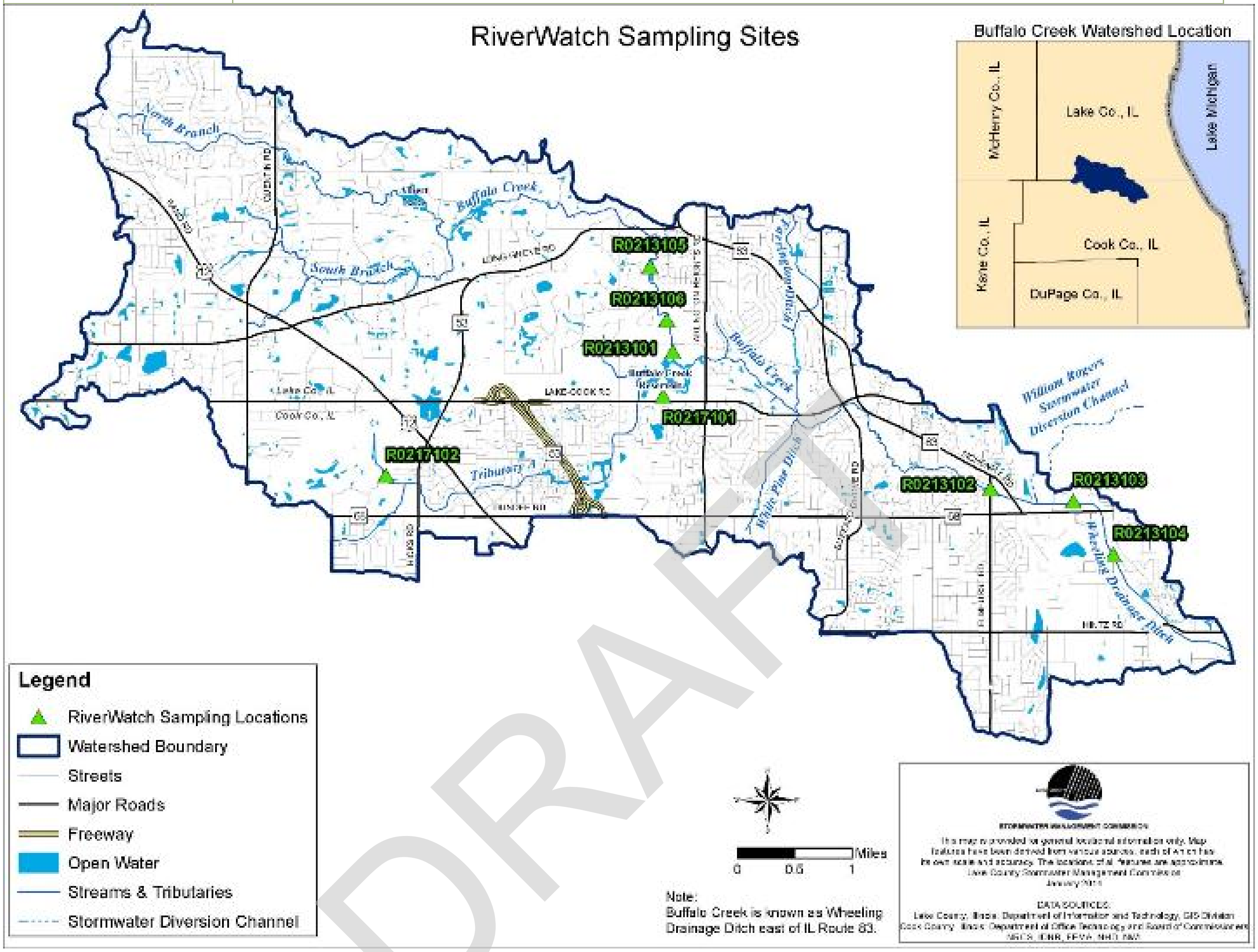


Figure 3-71: RiverWatch Sampling Locations in the Buffalo Creek Watershed.

Table 3-46: INDR RiverWatch Data Summary, Buffalo Creek, 1996-2014.

Site	Sampling Date	TXR	Taxa Richness Score	EPT Taxa Richness	EPT Taxa Richness Score	MBI	MBI Score
Wheeling Drainage Ditch (Site ID R0213101)	2000	6	Very Poor	1	Very Poor	5.9	Poor
	1998	10	Fair	2	Poor	5.6	Fair
	1997	11	Fair	2	Poor	6.2	Poor
	1996	9	Fair	3	Fair	5.7	Poor
Wheeling Drainage Ditch (Site ID R0213102)	2003	9	Fair	1	Very Poor	7.9	Very Poor
	2002	9	Fair	2	Poor	5.5	Fair
	2001	6	Very Poor	1	Very Poor	5.6	Fair
	2000	7	Poor	1	Very Poor	5.4	Fair
	1999	6	Very Poor	1	Very Poor	5.9	Poor
	1998	7	Poor	2	Poor	5.6	Fair
	1997	8	Poor	1	Very Poor	6.0	Poor
Wheeling Drainage Ditch (Site ID R0213103)	2003	5	Very Poor	0	Very Poor	5.9	Poor
	2002	10	Fair	1	Very Poor	5.7	Poor

	2001	8	Poor	1	Very Poor	6.0	Poor
	2000	6	Very Poor	1	Very Poor	5.8	Poor
	1999	9	Fair	1	Very Poor	5.6	Fair
	1998	10	Fair	1	Very Poor	5.8	Poor
Wheeling Drainage Ditch (Site ID R0213104)	1998	4	Very Poor	0	Very Poor	7.4	Very Poor
Wheeling Drainage Ditch (Site ID R0213105)	2014	5	Very Poor	0	Very Poor	6.3	Very Poor
	2013	8	Poor	2	Poor	4.7	Good
Buffalo Creek (Site ID R0213106)	2014	11	Fair	5	Excellent	5.2	Fair
Buffalo Creek Tributary (Site ID R0217101)	2014	8	Poor	1	Very Poor	6.8	Very Poor
	2013	4	Very Poor	1	Very Poor	6.0	Poor
	2012	8	Poor	1	Very Poor	6.0	Poor
Buffalo Creek Tributary (Site ID R0217102)	2014	7	Poor	0	Very Poor	6.2	Poor

Noteworthy: Illinois RiverWatch Network

The Illinois RiverWatch Network is a volunteer stream monitoring program that seeks to engage Illinois citizens by training them as Citizen Scientists. Each year at adopted stream sites in their communities, Citizen Scientists conduct habitat and biological surveys, including the collection and identification of small stream organisms called macroinvertebrates that serve as bioindicators of water quality.

RiverWatch was initiated in 1995 as part of the Critical Trends Assessment Project (CTAP), an IDNR project designed to conduct a long-term, comprehensive assessment of the environment in Illinois. In February of 2006, responsibility for RiverWatch was officially transferred to the National Great Rivers Research and Education Center (NGRREC℠) with support from the Office of Lieutenant Governor. NGRREC's unique location, strong partnerships, and mission make it an ideal home for RiverWatch. More information on the program can be found on the NGRREC's website at http://www.ngrrec.org/riverwatch/.